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AT HARVARD COLLEGE.
Vol. LX. No. 1.

NEW AND OLD SILURIAN TRILOBITES FROM SOUTH-EASTERN WISCONSIN, WITH NOTES ON THE GENERA OF THE ILLAENIDAE.

By Percy E. Raymond.

With Four Plates.

CAMBRIDGE, MASS., U. S. A.:
PRINTED FOR THE MUSEUM.
January, 1916.

No. 1.— *New and old Silurian Trilobites from Southeastern Wisconsin, with Notes on the Genera of the Illaenidae.*

By Percy E. Raymond.

In the F. H. Day collection, received in January 1881, as a gift of Mr. Alexander Agassiz, the Museum of Comparative Zoölogy secured one of the three great collections of the Silurian fossils of southeastern Wisconsin. It is particularly rich in Illaenidae, but contains also such rare forms as *Harpes telleri, Trochurus nasutus,* and *Dicranopeltis telleri,* to be found elsewhere only in Mr. Teller's magnificent collection.

The trilobite fauna of the quarries around Milwaukee and Racine differs considerably from that found in the vicinity of Chicago, so that some of the species described by Weller from the latter area are either absent from the M. C. Z. collection or represented by specimens from other sources than the Day collection. The Phacopidae have been omitted from the present study, and only such species are mentioned as are represented by specimens which add something to what has already been published.

ILLAENIDAE Hawle and Corda.

The Illaenidae form a remarkably homogeneous group, and in spite of the great number of species which have been described only three generic or subgeneric names (Illaenus, Bumastus, and Thaleops) are in common use. Holm recognized only Illaenus and Bumastus and other writers have been even more conservative, referring all the species to Illaenus. The only serious attempt to subdivide the genus is that made by Salter, who recognized eight subgenera (including Illaenus), but none of Salter's names has ever come into general use, although some of them could be adopted advantageously. In all, seventeen subgenera or genera have been proposed for inclusion in this family, but only seven of these seem to be valid. The names, in chronological order, are:— Cryptonymus Eichwald 1825, Illaenus Dalman 1826, Deucalion Shtsheglov 1827, Bumastus Murchison 1839, Archegonus and Dysplanus Burmeister 1843, Thaleops Conrad 1843, Alceste Hawle and Corda 1847, Rhodope Angelin 1854, Actinolobus Eichwald 1860, Panderia Volborth 1863, Illaenurus Hall 1863, Illaenopsis Salter 1866, Ectillaenus, Hydrolaenus, Octillaenus Salter, 1867, and Illaenoides Weller 1907. Certain other genera, such as Symphysurus and Nileus have often been placed with Illaenus, but they have more generally been recognized as belonging to the Asaphidae. The fundamental difference between the Illaenidae and the Asaphidae is, of course, the presence in the former family of an epistoma, and its absence in the latter. The absence of the grooves on the pleura of the thorax in the Illaenidae and their very general presence in the Asaphidae affords quite a safe criterion for judging of the dorsal surface.

The genera enumerated above may be taken up in order.

CRYPTONYMUS Eichwald, 1825.

Observations geognostico-zoologicae per Ingriam marisque Baltici Provincias nec non de Trilobites. Casani, 1825, p. 44.

In this paper, Eichwald, evidently not understanding Brongniart's genus Asaphus, describes the new genus Cryptonymus, and under it, eight species. The first four are species of Asaphus and the last four are species of Illaenidae. Asaphus had been described in 1822, but Illaenus was not published till 1826, so that, if the four asaphids were eliminated, it would really leave an illaenid as the type of Cryptonymus. The first of the illaenids described, *Cryptonymus rosenbergi*, is a Bumastus, the second, *Cr. wahlenbergi*, third, *Cr. rudolphii*, and the last, *Cr. parkinsonii*, are all species of Illaenus. To choose among these a type for Cryptonymus would be to upset one of two well-established names without any possible gain. Eichwald himself accepted Illaenus as the name of these species, and in 1840 transferred his name Cryptonymus to *Trilobites punctatus* Wahlenberg, a proceeding which he afterward stoutly defended (1855). If a new generic name is at any time necessary for any of the eight species described by Eichwald, Cryptonymus is still available, but till such a contingency arises, it seems best not to revive the name.

ILLAENUS Dalman, 1826.

Type, ASAPHUS CRASSICAUDA Wahlenberg.

Om Palaeaderna eller de sa kallade Trilobiterna. Kgl. Vet. akad. Handl., 1826, p. 248.

Dalman divided Asaphus into four sections, the third of which he designated as Illaenus, using the name in a subgeneric sense. Illaenus he divided into two divisions. Divisio 1, Cornigeri, contained the single species *Asaphus* (*Illaenus*) *centrotus,* which Burmeister made the type of Dysplanus in 1843. Divisio 2, Mutici, contained *Asaphus* (*Illaenus*) *crassicauda* and *A.* (*Illaenus*) *laticauda.* The first of these has by general consent been made the type of Illaenus. Holm has, in several papers, redescribed the typical species, so that its characteristics are well known. Beside the characters of the family, the species shows a short and wide, strongly convex and curved cephalon and pygidium, both without concave borders, large prominent eyes which are situated far back, deep but short glabellar furrows, short but rather wide free cheeks without spines on the genal angles. The thorax has a narrow axial lobe and ten segments. The pygidium has a short but prominent axial lobe, and is wider than long. As Clarke has pointed out, *Illaenus americanus* Billings is an American species which is very similar to *I. crassicauda,* and it seems that only such species as conform to the kind of structure exhibited by the type should be admitted to the restricted genus Illaenus.

DEUCALION Shtsheglov, 1827.

Sur les Trilobites en général et en particulier sur ceux de Zarskoë-Selo. Journ. für neue Endeckungen in der Phys. Chem. Natur. und Technologie St. Petersburg, 1827, no. 1, 2, p. 234, pl. 7, f. 9 a–c.

I have not seen this paper, but judge from what Holm says that Deucalion is a synonym of Illaenus. The genus was founded on a new species, *D. brongniarti,* which Holm was unable to recognize.

BUMASTUS Murchison, 1839.

Type, BUMASTUS BARRIENSIS Murchison (Partim).

Silurian system, 1839, p. 656 (non figs.).

The particular features of this genus upon which Murchison himself laid most stress were the absence of dorsal furrows, and the presence of ten segments in the thorax. The general usage, however, has been that of referring all illaenids having the axial lobe of the thorax very broad, its width equaling or exceeding one half the total width of the body, to the genus Bumastus. This practice will probably prevail, for we now know that other illaenids beside Bumastus have ten segments in the thorax, and there is no illaenid known from which dorsal furrows are absolutely absent. In view of the somewhat numerous subdivisions of the illaenids, it may be well to reëxamine the type-species, *Bumastus barriensis* Murchison, in a little detail. Salter has explained that the specimens figured by Murchison really do not belong to this species, so that we are obliged to use Salter's figures of the "Barr Trilobite." Fortunately the M. C. Z. collection contains two plaster casts of the original specimen figured by Jukes in 1829 and later by Salter. The casts are rather carelessly made, but are in general in fair agreement with Salter's figures. From these sources may be derived the statement that the typical species of Bumastus is a large Silurian illaenid with smooth, subequal cephalon and pygidium, rounded, spineless genal angles, large eyes, situated near the posterior margin of the cephalon, a very wide axial lobe, shallow dorsal furrows, ten segments in the thorax, and no trace of an axial lobe on the pygidium. The dorsal furrows on the cephalon are short, extending but little ahead of the eyes. The cephalon does not appear to have any rim or concave depression, but the pygidium shows a slight concavity, so that the profile of that member does not present a smooth convex curve, but the curvature is reversed near the posterior end of the pygidium. Both cephalon and pygidium are wider than long.

ARCHEGONUS Burmeister, 1843.

Die organisation der trilobiten, 1843, p. 120, 121, pl. 5, f. 3.

The type of this genus is *Calymene ? aequalis* H. von Meyer, as this was the only species cited by Burmeister in the first edition of his Organisation der trilobiten. As the type is evidently not an illaenid, but one of the Proetidae, the genus automatically disappears from the family.

DYSPLANUS Burmeister, 1843.

Die organisation der trilobiten, 1843, p. 120.

Type, ILLAENUS CENTROTUS Dalman.

The type of this genus is an illaenid with rather long, parabolic head and abdomen-shields, spines at the genal angles, small eyes far back, narrow axial lobe, and nine segments in the thorax. The profiles of both shields are rather flat but uniformly convex curves. (See especially Holm, Bihang Kogl. Vet. akad. Handl., 1883, **7**, pl. 4, f. 1–12). Holm was not able to see any value in this genus, pointing out that the only real characteristic brought forward by Burmeister and by Angelin was the presence of genal spines, and the species with genal spines are so highly variable among themselves as to suggest that this character in itself does not denote any real relationship. It seems, however, that a certain group of illaenids can properly be denoted by this term, and the genus will be referred to later.

THALEOPS Conrad, 1843.

Proc. Acad. nat. sci. Phil., 1843, **1**, p. 331.

Type, THALEOPS OVATA Conrad.

The presence in this species of very high eyes on long peduncles, long narrow genal spines, deep dorsal furrows sharply delineating a prominent glabella, a narrow axial lobe, ten thoracic segments, and a small short pygidium, mark an unusually well-defined genus which seems to be confined to North America, and probably to the Ordovician, though one Silurian species has been referred to the genus.

ALCESTE Hawle and Corda, 1847.

Prodr. monog. Bohm. tril., 1847, p. 66, pl. 4, f. 31.

Type, ALCESTE LATISSIMA Hawle and Corda (which is the same as *Illaenus hisingeri* Barrande, according to Barrande).

This genus is not valid, for it was based upon an immature specimen showing only four segments, and was very incorrectly described and figured. Without Barrande's explanation, no one would be able to identify the *Alceste latissima* with any Bohemian trilobite.

RHODOPE Angelin, 1854.

Pal. Scandinavia, 1854, pt. 1, Trilobita, p. 38, pl. 22, f. 17.

Type, RHODOPE LINEATA Angelin.

The name Rhodope was used for a gastropod by von Siebold in 1848 (Anatomie, p. 296), and Volborth replaced the name by Panderia.

ACTINOLOBUS Eichwald, 1860.

Type, ILLAENUS ATAVUS Eichwald, 1857.

Lethaea Rossica, 1860, **1**, p. 1488.

The type is an illaenid which seems sufficiently peculiar to deserve a distinct generic name. The cephalon is short and the pygidium long, and both cephalon and pygidium have a concave border; the cephalon a narrow lip, and the pygidium as wide a border as the average Isotelus. The eyes are rather large, far back and far apart, free cheeks small, genal angles rounded. The dorsal furrows of the cephalon are short, the axial lobe of the thorax is narrow; ten segments are present; and the axial lobe of the pygidium is short and triangular. *Actinolobus atavus* is a Russian Ordovician species (C1a), and another species with a wide border on the pygidium is the one from the Silurian described by Schmidt as *Illaenus masckei* (From F, Estland).

PANDERIA Volborth, 1863.

Type, PANDERIA TRIQUETRA Volborth.

Mem. Acad. imp. sci. St. Petersburg, 1863, **6**, no. 2, p. 31.

Although proposing this name primarily to replace the preoccupied Rhodope of Angelin, Volborth made his own new species the type, and the genus must rest upon it. Holm does not actually use Panderia, but he seems to have considered it a fit receptacle for the group of small trilobites with only eight thoracic segments, and gives (1883, p. 161) a new definition according to his interpretation of the genus. The presence of only eight segments in the thorax does not appeal very strongly to the present writer as a generic characteristic. *Panderia triquetra* does, however, present some rather unusual characteristics in its very short, strongly convex cephalon with extremely large eyes, the high, well-defined glabella, and the short pygidium with long, prominent axial lobe. Species of this type are not at all common, and may be referred to Illaenus without doing violence to the definition of that genus.

ILLAENURUS Hall, 1863.

Type, ILLAENURUS QUADRATUS Hall.

16th Rept. N. Y. state cab. nat. hist., 1863, p. 176, pl. 7.

Although Hall believed this species to be closely allied to Illaenus, as indicated by the name, it seems more probable that it belongs to the Asaphidae and is allied to Symphysurus.

ILLAENOPSIS Salter, 1866.

Type, ILLAENOPSIS THOMSONI Salter.

Mem. Geol. surv. Gt. Britain, 1866, 3, p. 256.

As has been repeatedly pointed out, the grooved pleura of the thorax of this trilobite exclude it from the Illaenidae, and place it near Symphysurus in the Asaphidae.

OCTILLAENUS Salter, 1867.

Type, ILLAENUS HISINGERI Barrande.

Monog. Brit. Silurian trilobites, 1867, pt. 4, p. 182.

This genus was erected by Salter to contain the type, a species in which the pleura of the first thoracic segment are produced into spines. There are eight segments in the thorax, the axial lobe is narrow, the glabella well defined, eyes of medium size and far back, free cheeks with sharp genal spines Pygidium about as long as wide, without defined axial lobe. This species could probably be placed with Dysplanus, but I would follow Salter in the recognition of the remarkable development of spines on the first thoracic segment, it being a unique example of such a characteristic among the smooth trilobites.

ECTILLAENUS Salter, 1867.

Type, ILLAENUS PEROVALIS Murchison.

Monog. Brit. Silurian trilobites, 1867, pt. 4, p. 182.

Holm has pointed out that in proposing this genus Salter confused the true *I. perovalis* of Murchison and a new species afterward described by Hicks as *I. hughesi*, and not understanding clearly the characteristics of either species, produced a name of no particular value. The name should be dropped, unless it can be shown to be of more value than now appears to be probable.

HYDROLAENUS Salter, 1867.

Type, ILLAENUS CONIFRONS Billings.

Monog. Brit. Silurian trilobites, 1867, pt. 4, p. 182.

The type-species is a Thaleops, and Hydrolaenus is therefore a synonym of that genus.

ILLAENOIDES Weller, 1907.

Type, ILLAENOIDES TRILOBUS Weller.

Bull. Chicago acad. sci., 1907, no. 4, pt. 2, p. 226.

The type of this genus is remarkable chiefly for its small eyes which are situated halfway to the front of the head. The glabellar furrows are narrow and shallow, the facial suture cuts the cheeks very close to the genal angles, making the free cheeks of unusual shape. The genal angles are rounded. The axial lobe of the thorax is wider than in typical Illaenus, but less wide than in Bumastus. The pygidium is long with a narrow concave border, but no trace of an axial lobe. Type and only known species from the Niagaran at Bridgeport (Chicago), Illinois.

Summary.— It appears that of the genera proposed, Illaenus, Bumastus, Thaleops, Actinolobus, and Illaenoides have unquestionable value. Dysplanus and Octillaenus are more or less valuable but need further study and redefinition. Cryptonymus, Deucalion, Panderia, and Ectillaenus are names which cannot be used at present, but might possibly be revived. Archegonus, Illaenurus, and Illaenopsis belong to other families. Alceste was never properly defined. Rhodope was preoccupied, and Hydrolaenus is a synonym. It is interesting to note the lapse of forty years between Salter's new names and the next generic name applied to a member of this group.

It is evident that the type-genus Illaenus contains the great majority of the species in this family, the other genera having, as a usual thing, only from one to two or three species each. Bumastus comes next to Illaenus in the number of species, and has its greatest development in America where there are at least six species in the Middle Ordovician and about fifteen in the Middle Silurian, as contrasted with three or four species in the Silurian of Great Britain, about the same number in Scandinavia and Russia, and two in Bohemia.

Considering the great abundance of the illaenids, we have surprisingly little information as to their ancestry or relationships. Following the usual theory, which seems to be borne out by the facts in most cases, one would expect these smooth forms to be the descendants of more normal trilobites with glabellar furrows and with ribs on the pygidium. But among all the illaenids there does not seem to be one which shows any trace of ribs on the pygidium, while only a few show indications of glabellar furrows. And such indications of furrows as exist are merely spots or slight depressions on the smooth glabella. The nearest relatives of the Illaenidae are undoubtedly the Goldiidae (Bronteidae) not the Asaphidae, with which family they have usually been classed. The presence in both the Illaenidae and the Goldiidae of an epistoma, similar hypostomas, forward expanding glabella, large eyes which are placed far back, unfurrowed pleura in the thorax, and short axial lobe on the pygidium, indicate a very close relationship, some of these characteristics being apparently too fundamental to admit of explanation on the ground of parallelism. The Goldiidae, in spite of their specialization, are more like the typical trilobite than the Illaenidae, and it would be natural to place them in the ancestral position. The geological range at once negatives this attempt, for the Goldiidae did not appear until the Middle Ordovician, are very rare in the Ordovician and reached their greatest development in the Silurian and Devonian. The illaenids, on the other hand, appeared in the basal Ordovician, possibly even in the Cambrian, reached their greatest development in the Middle Silurian and did not survive that period. That the Goldiidae should have been derived from the Illaenidae, however, seems highly improbable, for the phylogeny of the former family pursues a normal course, the oldest members of the family being most highly segmented, and the usual "smoothing out" process producing such (relatively) Illaenus-like species as *Goldius dormitzeri*, *G. campanifer*, and *G. brongniarti* in the Devonian of Bohemia. If these species, without glabellar furrows and with highly convex almost ribless pygidia occurred in the Ordovician, and forms like *Goldius lunatus* (Billings) in the Devonian, we should probably conclude at once that the Goldiidae were derived from the Illaenidae.

The oldest illaenids which are well known are those which Barrande described from the base of the Ordovician in Bohemia. Of these, *Illaenus advena* is a quite typical Illaenus, while the other species are peculiar. *Illaenus bohemicus*, the type of which is in the M. C. Z., was founded on a badly preserved single specimen, which does not seem to be an Illaenus. The pygidium shows a long, distinct, and ringed axial lobe and if this member were found alone, it would at once be assigned to the Asaphidae. The nine segments of the thorax are, however, without pleural furrows. The cephalon is too poorly preserved to indicate any characters of value. Long wide genal spines are present, the glabella appears to have nearly parallel sides until the vicinity of the anterior end is reached, when it expands abruptly. Rather faint glabellar furrows seem to be present. With only this single specimen, it does not seem possible to assign the species to any genus or even family, and it certainly throws no light on the origin of the Illaenidae. Another species from D_1, described by Barrande, is the common *Illaenus katzeri*. This species differs from other illaenids in its eyes. Barrande supposed it to be blind, but Holub has recently shown (Bull. international Acad. sci. Bohême, 1908. German abstract, p. 7, pl. 7) that it has small eyes, situated forward. Both shields are rather flattened, not so strongly incurved as in the typical genus Illaenus, and the pygidium is long and parabolic in outline, thus suggesting Dysplanus. There is nothing, however, to indicate that *I. katzeri* is primitive, but it seems rather, like the Silurian *Illaenoides trilobus*, to be a degenerate form. If the genus is divided at all, this species cannot be considered as congeneric with *Illaenus crassicauda*, and I would suggest that the name *Wossekia* be applied to it, since Wossek, Bohemia, is the locality from which practically all the specimens have been obtained. *Illaenus puer* seems to be, as Brögger was the first to point out, a Symphysurus. *Illaenus calvus* has a peculiar marginal rim. The species is known from a single fragment. *Illaenus aratus* has a narrow glabella, and the eyes are very far apart or absent. It is primitive for an illaenid, but gives no suggestion as to the origin of the group.

A pathologic specimen of Illaenus.—Since this paper was written, I have been enabled, through a grant from the Shaler Memorial fund at Harvard College, to visit northern Europe, and some time was spent in studying the collections in London, Berlin, St. Petersburg, Stockholm, and Christiania. One of the most interesting trilobites seen was the specimen of *Illaenus revelensis* Holm, which was figured by Holm in his description of the Russian Ordovician Illaenidae (Mem. Acad. imp. sci. St. Petersburg, 1886, ser. 7, **33**, pl. 2, f. 5a). This is the only example I have seen among trilobites of a malformation due to moulting. As partially shown in Holm's figure, there is an impressed line between the facial suture and the dorsal furrow on the left side, which follows exactly the course of a facial suture, even extending across the front of the cranidium, a point not shown in Holm's figure. Across the posterior part of the cephalon, close to the edge, is a furrow marking the posterior edge of the shell at the time of the previous moult. The eye on the left side is smaller than its opposite, and the palpebral lobe is malformed. The cephalon is decidedly unsymmetrical, the left free cheek being drawn backward. All these pathological features seem to be due to the partial retention of the shell at the next previous moult.

Classification of the Illaenidae.

From the first, all classifications of the Illaenidae have rested mainly upon the number of segments in the thorax, and secondarily upon the width of the axial lobe of the thorax. Thus, Dalman, the describer of Illaenus, separated the species with nine segments from those with ten. Holm, the principal writer upon the genus, while recognizing only the genus Illaenus and the subgenus Bumastus, divided Illaenus into three groups, those with ten, nine, and eight segments in the thorax. A study of the American illaenids does not favor a classification of this sort, for it has been repeatedly shown that the number of thoracic segments in species of both Illaenus and Bumastus is variable, even within the limits of a single species. Likewise, the presence or absence of genal spines is not a characteristic justifying, in itself, the erection of a genus of Illaenidae, for, as has been several times pointed out, species are found with all sorts and conditions of spines, and if all species having this characteristic were to be referred to a single genus, there would be hardly another characteristic common to the assemblage. The length and convexity of the cephalon and pygidium, the size and position of the eyes, the width of the axial lobe of the thorax, and the shape of the glabella seem of the most importance, but I would also take into consideration the sort of genal spines which may be present. It is still too early to make any natural classification, and the genera here recognized are based primarily upon the more conspicuous peculiarities of the type-species of each.

ILLAENIDAE Hawle and Corda.

Opisthoparia with large, convex, nearly smooth, cephalic and abdominal shields. Epistoma large, hypostoma convex, ovoid. Thorax of eight to ten segments, with unfurrowed pleura. Pygidium without ribs, axial lobe short or absent. Ordovician and Silurian.

ILLAENINAE, subf. nov.

Illaenidae with narrow axial lobe, cephalon and pygidium without concave border.

Illaenus Dalman. Cephalon and pygidium very convex, wider than long, abruptly deflected; eyes large and far back, axial lobe of pygidium high. Genal spines, when present, rounded in section. Type, *Illaenus crassicauda* (Wahlenburg). Ordovician and Silurian. Europe, North and South America, India, and Australia.

Thaleops Conrad. Cephalon and pygidium similar to Illaenus, but with eyes on long stalks and elongate genal spines always present. Type, *Thaleops ovata* Conrad. Ordovician and possibly Silurian. North America.

Dysplanus Burmeister. Cephalon and pygidium long and flattened, parabolic in outline, genal spines present, usually flattened. Type, *Illaenus centrotus* Dalman. Ordovician. Northern Europe.

Wossekia, gen. nov. Cephalon and pygidium as in Dysplanus, genal spines absent, eyes small and far forward. Type, *Illaenus katzeri* Barrande. Basal Ordovician. Bohemia.

Octillaenus Salter. Similar to Dysplanus but with rounded genal spines, and pleura of first segment elongated into spines. Type, *Illaenus hisingeri* Barrande. Ordovician. Bohemia.

BUMASTINAE, subf. nov.

Illaenidae with (usually) concave border on one or both shields, axial lobe generally wide, though sometimes narrow.

Bumastus Murchison. Axial lobe of thorax equal to more than half the total width; eight to ten segments. Typically, a concave border is present on the pygidium, frequently on both cephalon and pygidium, rarely (in small Middle Ordovician species) without concave border on either shield. Eyes very large. Type, *Bumastus barriensis* Murchison. Ordovician and Silurian. North America. Silurian. Europe.

Actinolobus Eichwald. Axial lobe narrow, cephalon short, pygidium long, with very wide concave border. Eyes large. Type, *Illaenus atavus* Eichwald. Ordovician, Russia. Silurian. Russia and United States.

Illaenoides Weller. Axial lobe with a width between that of Actinolobus and Bumastus, eyes very small and far forward, narrow concave border on pygidium. Type, *Illaenoides trilobus* Weller. Silurian. United States.

The above classification is designed to separate the species with long more or less flattened shields from the more typical illaenids with short and abruptly deflected cephalon and pygidium. The first two genera are modifications of the central Illaenus type, the other three of the more flattened Dysplanus group. In defining the subfamily Bumastinae as I have, all the forms with a more or less Isotelus-like pygidium are removed from the typical Illaenus group. Among the small species constituting the earliest of the Bumastinae one finds species like *B. globosus* Billings, *B. bellevillensis* Raymond and Narraway, and a few others, which lack a concave border. On the other hand, so large a Middle Ordovician Bumastus as *B. indeterminatus* (Walcott), the type of which is figured (Plate 2) for the first time, has a distinctly concave border. It is very possibly true that the small species mentioned above should be given a distinct name and placed in the Illaeninae, but it still seems somewhat early to take so radical a step.

Description of species.

We owe to Professor Weller a complete and careful description of the Illaenidae of the Chicago area, and, as he had access to collections made at Racine and near Milwaukee, his description in large measure covers the Wisconsin area also. In the large collections which I have been able to examine, I have, however, found a few specimens more perfect than those previously described, and also a few new species. When first studying the excellent figures given by Weller, one is struck by the apparent triviality of the specific characteristics employed in the discrimination of the species, but with a large collection, it is found that the characteristics are remarkably constant. The study of these illaenids is unusually interesting, in fact, for it seems to be one of the few cases where characteristics arbitrarily chosen may serve to define natural groups. The bumastids particularly, which are simple trilobites with few variable characters, seem to be susceptible to this sort of treatment. The chief variable characters are amount of convexity, ratio of length to breadth, length of dorsal furrows, presence or absence of "lip" on cephalon and concave border on pygidium, and size of eyes. Almost every possible combination of these few characteristics seems to be present among the species, and each combination is usually exhibited by a large number of specimens. That these variations are not the attributes of one very plastic species but of a number of distinct species is shown by the geographical distribution as well as by the numbers in each group. For example, *Bumastus insignis* seems to be confined to a small area in the immediate vicinity of Chicago, and *B. ioxus* to Joliet, Illinois and Racine, Wisconsin, while *B. cuniculus* is found in vast numbers near Milwaukee, but is rare in the Chicago area. Others of the species are equally local in distribution.

BUMASTUS CUNICULUS (Hall).

Illaenus cuniculus Hall, 20th Rept. N. Y. state cab. nat. hist., 1868, p. 377, pl. 22, f. 12; 1870, rev. ed., p. 421, pl. 22, f. 12. Weller, Bull. Chicago acad. nat. hist., 1907, no. 4, pt. 2, p. 219, pl. 19, f. 1–6.

This is by far the most common species at Wauwatosa, Wisc. There are several nearly complete specimens in the M. C. Z., most of them enrolled. They show the axial lobe of the thorax to be extremely wide, and the dorsal furrows very shallow. There are ten segments. The diagnostic specific characteristics are: — elongate, moderately convex cephalon with very narrow rim which is prominent at the front, but disappears before reaching the genal angles, and eyes of medium size. Dorsal furrows faint, hardly visible at all in front of the scar-like spots just inside the eyes. Pygidium elongate, moderately convex, with practically no depressed border. A flattening of the convexity near the border can be seen if the pygidium is viewed in profile.

Measurements: — A cephalon of average size is 45 mm. long, 55 mm. broad; the eye 9 mm. long, or one fifth the total length. A large cephalon is 56 mm. long. The pygidium of an enrolled specimen whose cephalon is 45 mm. long is 50 mm. long and 52 mm. wide. The axial lobe of this specimen is 42 mm. wide and the total width of the thorax is 53 mm.

Formation and locality: — Very common in the Niagaran at Wauwatosa, near Milwaukee, Wisconsin.

BUMASTUS NIAGARENSIS (Whitfield).

Plate **1**, fig. 3.

Illaenus niagarensis Whitfield, Ann. rept. Geol. surv. Wisconsin for 1879, 1880, p. 68. Weller, Bull. Chicago acad. sci., 1907, no. 4, pt. 2, p. 219, pl. 19, f. 7–11.

Illaenus madisonianus Whitfield. Geol. Wisc., 1882, **4**, p. 307, pl. 20, figs. 8–9. Foerste, Bull. sci. lab. Den univ., 1885, **1**, p. 106, pl. 14, f. 1a–b, 2a–b; 1887, **2**, p. 93, pl. 8, f. 8, 9, 10, 10a; Geol. surv. Ohio, 1893, **7**, p. 526, pl. 26, f. 1, 2, varieties, pl. 27, f. 7–10. Van Ingen, School of mines quarterly, Columbia univ., 1901, **23**, p. 35.

This seems to be one of the few illaenids of the Chicago-Wisconsin Niagaran area which has hitherto been known from entire specimens. Whitfield figured an entire one, Weller had a nearly complete specimen, and there are five in the M. C. Z. (Day collection). One of these is figured as it shows some characters not shown in either Whitfield's or Weller's figure. Whitfield's figure, if it really represents this species, is inaccurate in respect to the glabellar furrows, which are really much longer than is indicated by his figure or description. From the general proportions of the body, and the position of the eyes, it would seem that his figure really does represent this species. The specimen here figured is a little longer and narrower than those previously figured, and has a longer and more pointed pygidium.

It will be noted that the thorax is exceedingly short, though ten segments are present. The dorsal furrows do not show in the figured specimen, but they do on another specimen in the M. C. Z. collection, and are also indicated in Whitfield's figure.

The specific characteristics are: — cephalon rather convex, with long dorsal furrows, no lip or concave border on the cephalon. Eyes of medium size, situated nearly their own length from the posterior margin, thorax short, pygidium long, rather pointed behind, with narrow concave border.

Measurements: — The specimen (Plate **1**, fig. 3) is 58 mm. long; cephalon 22 mm. long, 31 mm. wide; thorax 13.5 mm. long; pygidium 29 mm. long, 29 mm. wide; the eyes are damaged. On a very good enrolled specimen preserving the test, the cephalon is 24 mm. long, the eye 5 mm. long, and 5 mm. from the posterior margin. On a larger specimen the eye is 1 mm. more than its own length from the posterior margin.

Formation and locality: — This species is quite common in the Niagaran at Wauwatosa, though not nearly so common as *B. cuniculus.*

BUMASTUS DAYI, sp. nov.

Plate 1, fig. 8–10.

The Day collection contained two fine specimens labeled *sp. nov.*, and as they have proven to be such I have named them in honor of the collector. The specific characteristics are: — cephalon and pygidium short and convex, eyes large and far back, no lip or concavity at the front of the glabella, though there is one at the sides of the free cheeks, dorsal furrows of the cephalon long, reaching the pits in front of the eyes.

Thorax of ten segments, axial lobe very wide, furrows shallow. Pygidium short and evenly convex, with only a trace of a concave margin.

It will be at once noted that this species is much like *B. niagarensis,* but has large eyes far back, and the pygidium is shorter and with less depressed margin. It differs from *B. cuniculus* in having long instead of short dorsal furrows on the cephalon, and in lacking the rim at the front. Of the species found near Chicago, *B. chicagoensis* (Weller) is very similar to this but that species has a much shorter and more abruptly deflected cephalon.

Measurements: — The type is 46 mm. long; cephalon 19 mm. long, 26 mm. wide; eye 7 mm. long and 2 mm. from posterior margin; thorax 14 mm. in length; pygidium 23 mm. long, 25 mm. wide. A large cephalon is 34 mm. long, 46 mm. wide; eye 11 mm. long, 4 mm. from posterior margin.

Formation and locality: — Quite common in the Niagaran at Wauwatosa, Wisc.

BUMASTUS DECIPIENS, sp. nov.

Plate 1, fig. 1, 2.

Exceedingly like *B. dayi* is a species of which the collection contains only five or six specimens, two of which are approximately entire. The specimens are of about the same size as the smaller ones of *B. dayi,* and the principal difference between the two is that *B. decipiens* has short glabellar furrows and no lip on the free cheek, while *B. dayi* has long furrows and a lip on the free cheek. The eye of *B. decipiens* seems also to be a little longer and further back than in *B. dayi*. The pits in front of the eyes are exceedingly faint.

Bumastus transversalis (Weller) likewise has a short head, large eyes, and short dorsal furrows, but is much wider than *B. decipiens*. *B. armatus* (Hall) is much like *B. decipiens* but has spines at the genal angles.

Measurements: — The holotype (Plate 1, fig. 2) an imperfect cranidium, is 19 mm. long; the eye is 7.5 mm. long, and 2 mm. from the posterior margin. The figured paratype (Plate 1, fig. 1) is about 51 mm. long; cephalon 21 mm. long; thorax 15 mm. long. A second small, unfigured paratype has the cephalon 12 mm. long, 16 mm. wide; eye 5 mm. long; 1 mm. from posterior margin; thorax 8 mm. long; pygidium 12 mm. long, and about 16 mm. wide.

Formation and locality: — All the specimens are from the Niagaran at Wauwatosa, Wisc.

BUMASTUS TENUIS, sp. nov.

Plate 1, fig. 6, 7 and ? 11.

This species is like *B. decipiens*, rare, and the collection contains five specimens showing the cranidium only. It is characterized by its slight convexity and the very wide concave lip at the front. The dorsal furrows are long, reaching to the pit in front of the eyes. These pits are themselves very far forward and close to the margin. The eyes are large and close to the posterior margin.

This species of course suggests *B. cuniculus*, but the lip is much wider, the dorsal furrows longer, and the pits in which they end very close to the margin. It has a flatter cephalon and wider lip than any known Bumastus.

A pygidium (Plate 1, fig. 11) which does not seem to belong with any other species found at Wauwatosa is tentatively referred to *B. tenuis*. It is too short and not convex enough for *B. niagarensis*, and has too wide a concave border for *B. cuniculus, B. dayi*, or *B. decipiens*.

Measurements: — The type cranidium is 33 mm. long and 34 mm. wide at the palpebral lobes. The eye was approximately 8 mm. long and 2 mm. from the posterior margin.

Formation and locality: — All the specimens are from the Niagaran at Wauwatosa, Wisc.

BUMASTUS INSIGNIS (Hall).

Illaenus insignis Hall, 18th Rept. N. Y. state cab. nat. hist., 1865, p. 27, f. 5, 6 adv. sheets; 20th Rept. N. Y. state cab. nat. hist., 1868, p. 331, f. 5, 6, pl. 22, f. 13, 14; 1870, rev. ed., p. 419, f. 10, 11, pl. 22, f. 13, 14. Weller, Bull. Chicago acad. nat. sci., 1907, no. 4, pt. 2, p. 215, pl. 17, f. 1–5. Not of Salter, Whitfield, Foerste, and Kindle. (See Weller, op. cit.).

It is interesting to note that though Hall cites Waukesha and Milwaukee, Wisc., first in his list of localities for this species, the species is not known at all from Wisconsin, and the specimens which Hall figured were undoubtedly from near Chicago. Whitfield's *Illaenus insignis* was *B. cuniculus* (Hall). The English specimens figured by Salter as belonging to this species, show the same long furrows and cephalon with a lip, but the front of the head is not so pointed. The eyes of the English form are likewise less elongate and further back than in specimens from near Chicago. It seems probable that the English form deserves a distinct name, and *B. pomiata*, the name used by Salter on the plate of his publication, is still available.

BUMASTUS IOXUS Hall.

Illaenus (*Bumastus*) *barriensis* ? Hall, Geol. surv. Wisc., 1862, **1**, p. 433, (no description); 18th Rept. N. Y. state cab. nat. hist., 1865, p. 28 adv. sheets; 20th Rept. N. Y. state cab. nat. hist., 1868, p. 332.

Illaenus ioxus Hall, 20th Rept. N. Y. state cab. nat. hist., 1868, p. 387, fig., pl. 22, f. 4–11, pl. 23, f. 1. Whitfield, Geol. Wisc., 1882, **4**, p. 304, pl. 21, f. 11, 12. Foerste, Proc. Boston soc. nat. hist., 1890, **24**, p. 268, pl. 5, f. 20. Van Ingen, School of mines quarterly, Columbia univ., 23, 1901, p. 35 (no description). Kindle, 28th Ann. rept. Dept. geol. and nat. res. Indiana, 1904, p. 480, pl. 22, f. 7, pl. 23, f. 3 Weller, Bull Chicago acad. sci., 1907, no. 4, pt. 2, p 222, pl. 18, f. 1–3.

Illaenus (*Bumastus*) *ioxus* Hall, 20th Rept. N. Y. state cab. nat. hist., 1870, rev. ed., p. 420, f. 12, pl. 22, f. 4–10. ? 11th Rept. Dept. geol. and nat. hist. Indiana, 1882, p. 335, pl. 38, f. 14, non 13; Trans. Albany inst., 1883, **10**, p. 76.

The status of the name of this species is somewhat like that of *Cheirurus niagarensis*. In the Pal. N. Y., **2**, Hall identified the rather common large Bumastus of the Rochester shale as *B. barriensis* Murchison, and in his earlier references to the Wisconsin specimen he used the same name. When he came to figure a Wisconsin specimen, however, he proposed a new specific name for it, and the name was so obviously suggested by the Wisconsin specimens that I agree with Weller that those specimens should be considered the types of *B. ioxus*.

Professor Weller has suggested that the specimens from New York may belong to another species. I have investigated the point as fully as the material at my command would permit, and have not so far been able to find any really good characteristics on which to base a separation. The best specimens from New York are usually small, and considerably flattened. The study of better material will probably reveal characteristics not now evident, and I have therefore omitted from the synonymy the references to the New York specimens.

Hall figured a pygidium which he assigned to the species, undoubtedly correctly, but up to the present the thorax has been unknown. The M. C. Z. (Day collection), contains a large specimen, whose label states that it is the "only perfect specimen found at Racine." It is not exactly a perfect specimen, though it retains cephalon, parts of ten thoracic segments and the pygidium. The axial lobe of the thorax is somewhat less wide than one would have expected from the large size of the animal, but, being 62% of the total width, is about the general average among the bumastids. The pygidium does not show an actual concave border, but there is a very decided flattening of the curve of the profile at the back.

As the specimen is preserved, the pygidium is somewhat unnaturally drawn in, so that the actual length is not shown. On the other hand, the last thoracic segment is displaced from the others and there is a considerable space between the thorax and cephalon at the anterior end, and between the thorax and pygidium behind. The length of this specimen, therefore, gives only a rough approximation of the correct length. Incidentally it should be noted that the cephalon of this species has a large median tubercle near the posterior margin. It is shown in Hall's figure, but omitted from Weller's.

Measurements: — Length, about 180 mm.; cephalon 75 mm. long, 110 mm. wide; thorax about 75 mm. long, about 100 mm. wide at middle, axial lobe 62 mm. wide; pygidium 65 mm. long, 102 mm. wide. A well-preserved pygidium is 68 mm. long and 100 mm. wide.

Formation and locality: — Hall mentions Waukesha and Wauwatosa as localities for this species, but in very extensive collections from these places no specimens of this species are present, while we have a number of specimens from the Racine dolomite at Racine, Wisc.

BUMASTUS GRAFTONENSIS Meek and Worthen.

Illaenus (*Bumastus*) *graftonensis* Meek and Worthen, Proc. Acad. nat. sci. Phil., 1870, p. 54; Geol. surv. Illinois, 1875, **6**, p. 508, pl. 25, f. 4.
Bumastus sp. ind. Meek and Worthen, Geol. surv. Illinois, 1875, **6**, pl. 24, f. 3.
Illaenus graftonensis Weller, Bull. Chicago acad. sci., 1907, no. 4, pt. 2, p. 223, pl. 16, f. 4–6.

Only the cephalon of this species has previously been known, but the Day collection contains two complete, though somewhat flattened specimens from Waukesha, Wisconsin, where this species seems to be fairly common.

The cephalon is too well known to need further description, except to note that as in *B. ioxus,* there is a prominent median tubercle between the eyes and near the posterior margin.

The thorax has ten segments, a broad axial lobe, rather well-defined dorsal furrows. The pleura of the thoracic segments are more prominent and ridged, and not so flat as in most species of Bumastus. The pygidium is short and moderately convex, with a flattening around the margin, but not a real concave border. The pygidium resembles that of *B. ioxus,* but is shorter and wider, the average ratio of length to width in *B. ioxus* being .64 and in the two pygidia of *B. graftonensis* which we have, .54.

Formation and locality: — Nine specimens (M. C. Z. coll.) are from the Niagaran at Waukesha, Wisc., a locality from which this species has not previously been reported.

BUMASTUS INDETERMINATUS (Walcott).

Plate **2**.

Illaenus indeterminatus Walcott, 31st Ann. rept. N. Y. state mus. nat. hist., 1877, p. 19 adv. sheets; 31st Ann. rept. N. Y. state mus. nat. hist., 1879, p. 70.
Illaenus cf. *I. indeterminatus* Clarke, Pal. Minn., 1897, **3**, pt. 2, p. 716, f. 24.
Bumastus indeterminatus Raymond and Narraway, Ann. Carnegie mus., 1908, **4**, p. 253, pl. 62, f. 8, 9.

The M. C. Z. contains the type of this species, and it is figured (Plate **2**) for the first time. The specimen consists of a good cephalon, part of one free cheek, a very much dislocated thorax, of which only seven segments can be definitely made out, and a very fine pygidium.

The pygidium is considerably longer and more convex than the cephalon, and the axial lobe is evidently very wide and without very strong dorsal furrows.

The dorsal furrows of the cephalon fade out just before reaching the pits in front of the eyes, but this is probably an individual variation. These pits are not directly in front of the eyes as in most species of Bumastus, but considerably inside the projection of a line drawn through the length of the eye.

The pygidium is very convex, with concave slopes to the lateral and posterior margins.

Formation and locality: — The type, M. C. Z. no. 650, is from Russia (Newport), Herkimer Co., New York. The horizon is the Leray-Black River (Ordovician).

ACTINOLOBUS AMERICANUS, sp. nov.

Plate **1**, fig. 4, 5.

The M. C. Z. contains a single pygidium which, on account of its great length and wide flat border, is referred to Actinolobus, a genus previously unrepresented in this country. The specimen is damaged on the right side and has been restored in plaster.

There is also a break on the left side not shown in the figure, but the outline is believed to be accurate. The specimen is 38 mm. long and 20 mm. wide at the front. At the widest part, the border has a width of 10 mm. and is somewhat concave. The central part of the pygidium is strongly convex. The anterior margin indicates that the axial lobe of the thorax was wide, though not so wide as in the species of Bumastus found with it.

Formation and locality: — From the Racine dolomite at Racine, Wisconsin.

LICHADIDAE Hawle and Corda.

TROCHURUS NASUTUS (Weller).

Plate **3**, fig. 1, 2.

Dicranopeltis nasuta Weller, Bull. Chicago acad. sci., 1907, no. 4, pt. 2, p. 240, pl. 22, f. 5–7.

A figure of the specimen of this species in the Day collection is introduced in order to show the way in which the frontal lobe of the glabella tapers into a spine, this feature not being correctly shown by Weller's figures. I had at first believed that this specimen represented a distinct species, but fortunately was able to see the type in Mr. Teller's collection. That the species belongs to Trochurus instead of Dicranopeltis is shown by the dorsal furrows, which curve inward instead of outward, at the posterior ends.

Formation and locality: — The specimen is from the Niagaran at Wauwatosa, Wisconsin.

ODONTOPLEURIDAE Burmeister.

CERATOCEPHALA GONIATA Warder.

Plate **3**, fig. 3–5.

Ceratocephala goniata Warder, Amer. journ. sci., 1838, ser. 1, **34**, p. 378, fig. Clarke, 44th Rept. N. Y. state mus. nat. hist., 1892, p. 91–100, pl. 1, f. 1. Kindle, 28th Ann. rept Dept. geol. and nat. res. Indiana, 1904, p. 480, pl. 24, f. 13. Weller, Bull. Chicago acad. sci., 1907, no. 4, pt. 2, p. 255, pl. 23, f. 1–2. Raymond, Bull. Victoria mem. mus., 1913, **1**, p. 38.

Acidaspis danai Hall, Geol. surv. Wisc., 1862, **1**, p. 432 (no description); 18th. Rept. N. Y. state cab. nat. hist., 1865, p. 28, adv. sheets; 20th Rept. N. Y., state cab. nat. hist., 1868, p. 333, pl. 21, f. 8–9; 1870, rev. ed., p. 423, pl. 21, f. 8, 9.

Acidaspis ida Winchell and Marcy, Mem. Boston soc. nat. hist., 1865, **1**, p. 106, pl. 3, f. 13.

The cephalon of this species is, thanks to Professor Weller, now well known, but hitherto the thorax and pygidium have not been noticed. The Day collection in the M. C. Z. contains parts of two pygidia and a fragment showing a portion of five segments of the thorax. The pygidium is like that of *Acidaspis portlocki* Barrande, with a large median spine, on each side of which are two smaller spines, then a large spine, and finally an outer small spine. Each spine gives off small thorns on each side. The thorax is similar to that of *C. verneuili* Barrande. However, as only the central portion has been seen this part of the body would not be expected to show specific characteristics. The cephalon seems to be more nearly allied to *C. vesiculosa* than to *C. verneuili*, and a cephalon in the M. C. Z. gives indication that marginal spines were present on the free cheeks. The pygidium found with the cranidia at Wauwatosa are unlike those ascribed to *C. vesiculosa* by

Barrande, and, on the other hand, though the pygidia in the Day collection are much like that of *A. portlocki*, their cephalons are very unlike those assigned to *A. portlocki* by Barrande.

Formation and locality: — The specimens figured are from the Niagaran at Wauwatosa, Wisc.

ENCRINURIDAE Angelin.

ENCRINURUS REFLEXUS, sp. nov.

Plate 3, fig. 7, 8.

The Day collection contains several pygidia of an Encrinurus which is larger and differs in various ways from any species of this genus heretofore described from Silurian strata of this country.

Cephalon and thorax unknown.

Pygidium large for the genus, triangular, pleura bent abruptly downward, the posterior end somewhat turned up. Axial lobe very long, tapering backward to a point. It is marked by about thirty rings which are prominent and sharp toward the front, but very faint at the posterior end. With the exception of two at the anterior end the rings do not cross the axial lobe, but leave a narrow smooth space along the median line. Along this smooth lane are disposed eight pustules, approximately evenly spaced. On the pleural lobes are eight pairs of broad flat ribs which curve backward, making a rather abrupt turn near their outer ends. They do not reach quite to the margin, and end in blunt free spines which project from the sides a little above the margin. At the posterior end the last two ribs from each side converge alongside the axial lobe, and, with a small median spine, project beyond the end of the axial lobe. The ribs have small pustules scattered somewhat irregularly over them, and not aligned in longitudinal rows. Nearly every rib has a pustule at its inner end and one near the middle. Some of the ribs have only these two, but the longer ones near the front have another.

Measurements: — The more complete of the cotypes is 28 mm. long, 26 mm. broad at the front. The axial lobe is 9 mm. wide at the front and 26 mm. long.

Comparison with other species: — Nine species of Encrinurus have previously been described from the Silurian of America, but most of them are of much smaller size than the present species and only two species, *E. deltoideus* Shumard and *E. nereus* Hall, have as many as eight pairs of ribs. Most of the species have seven pairs, one, *E. americanus* Vogdes, has six, and *E. elegantulus* Billings has only five. The species may be taken up in alphabetical order.

E. americanus Vogdes (Description new Crustacea from Clinton of Georgia, 1866, p. 1), has only six pairs of ribs on the pleura, and no pustules, thus ruling it out at once.

E. deltoideus Shumard (Geol. Missouri, 1855, p. 198, pl. B, f. 10), is similar in many ways to *E. reflexus,* having the rings very numerous, twenty-four in number, and interrupted by a smooth lane. There are, however, no pustules except very indistinct granules, on this lane, and the ribs, of which there are eight pairs, are likewise smooth.

E. egani S. A. Miller (Journ. Cinc. soc. nat. hist., 1880, **2**, p. 254, pl. 15, f. 1, 1b), has a long terminal spine, only seven pairs of ribs, which are narrow with wide interspaces, and while the axial lobe of the pygidium is on the same plan as in *E. reflexus*, it has fewer rings and tubercles.

E. elegantulus Billings (Cat. Silurian fossils Anticosti, 1866, p. 62), has only five pairs of ribs, the median lane on the axial lobe is without tubercles, but the first eight rings cross it.

E. indianaënsis Kindle (28th Ann. rept. Dept. geol. and nat. res., Indiana, 1904, p. 482, pl. 24, f. 14, 15), is a very peculiar species, not at all of the same type as the one under discussion. It has fifteen rings on the axial lobe and ten pairs of ribs. Each rib crosses the axial lobe and has three to five tubercles.

E. nereus Hall (20th Rept. N. Y. state cab. nat. hist., 1868, p. 375, pl. 21, f. 15) has no flattened lane along the top of the axial lobe, and no nodes on the rings or ribs.

E. ornatus Hall and Whitfield (Pal. Ohio, 1875, **2**, p. 154, pl. 6, f. 16) is quite similar to the present species, but has only seven pairs of ribs, and the ribs themselves are narrower and the spaces between them wider. There are also only twenty rings and five nodes on the axial lobe.

E. thresheri Foerste (Bull. Sci. lab. Denison univ. 1887, **2**, p. 101, pl. 8, f. 26) is a small species which is similar to the last and to *E. reflexus*. There are, however, only seven pairs of ribs, which are themselves exceedingly narrow; there are also only eighteen rings on the axial lobe, and six pustules on the smooth lane.

E. tuberculifrons Weller (Bull. Chicago acad. sci., 1907, no. 4, pt. 2, p. 259, pl. 24, f. 12, 13) is a small form with a short wide pygidium which is without nodes and the rings of which cross the axial lobe without interruption.

Formation and locality: — From the Niagaran at Wauwatosa, Wisc.

CALYMENIDAE Milne Edwards.

CALYMENE NIAGARENSIS Hall.

Calymene niagarensis Hall, Geol. N. Y., 1843, pt. 4, p. 102, f. 3 on p. 101; tab. org. rem. 10, f. 3.

Calymene blumenbachi var. *niagarensis* Hall, Pal. N. Y., 1852, pt. 2, p. 307, pl. 67, f. 11, 12.

Calymenes are difficult fossils to differentiate satisfactorily, but it is possible to draw a little closer limits to some of the species than has been done in the past. The Silurian species do not present so difficult a problem as do those in the Ordovician, specific characteristics being apparently more fixed and constant in later times. Before venturing to separate two new species, it is best to direct attention for a moment to the well-known (in name) Silurian form.

The name was applied originally by Hall to specimens from the Rochester shale at Lockport, N. Y. The figures and description show the original specimens to have been of the *Calymene blumenbachi* type, that is with a narrow lip in front of the glabella, three pairs of glabellar lobes, and pygidium with an impressed line on each rib, distinctly bifurcating the outer portion. The ribs also reach practically to the margin.

It seems that the species *Calymene niagarensis* should be restricted to such trilobites as show these important characteristics of the types and these may be seen in most of the Calymenes in the Rochester shale. Another Calymene found at the same horizon, *C. rogdesi* Foerste, has the same bifurcated ribs on the pygidium, but a much longer snout-like lip in front of the glabella. It is also a much larger form, one of the largest of the Calymenes.

In the Ordovician the common *Calymene senaria* of the Trenton has the same type of bifurcated rib, while the later *C. meeki* Foerste, so abundant in the Eden and Maysville at Cincinnati, shows only a trace of an impressed line on the ribs, and often the line is absent entirely.

CALYMENE BREVICEPS, sp. nov.

Plate **3**, fig. 11.

Calymene niagarensis Hall, 28th Rept. N. Y. state mus. nat. hist., doc. ed., 1877, pl. 32, f. 8–15; mus. ed., 1879, pl. 32, f. 8–15; 11th Rept. Dept. geol. and nat. hist. Indiana, 1882, p. 331, pl. 34, f. 8–15. Hall and Clarke, Pal. N. Y., 1888, **7**, pl. 1, f. 10–14.

The Calymene abundant at Waldron, Indiana, has always been identified with *C. niagarensis*, but differs from that species in at least two marked details. The first and most obvious characteristic is that there is no lip, nor any furrow between the glabella and the rim, so that the glabella reaches upon, and in some cases, overhangs the rim, a feature usual in the Cheiruridae but extremely uncommon among the Calymenidae. This gives the cephalon the high, short appearance which suggested the name *breviceps*. On the pygidium the ribs reach nearly to the margin but become faint on approaching it. Ordinarily the ribs do not bear any median impressed line though traces of one may be seen on some specimens.

This species is in many ways much like *C. celebra*, the next species described.

Formation and locality: — This species is so far known only from the (Silurian) Waldron shale at Waldron, Indiana, where it is very common.

CALYMENE CELEBRA, sp. nov.

Plate 3, fig. 9, 10.

Calymene blumenbachii var. *niagarensis* Hall, Geol. surv. Wisc., 1862, **1**, p. 432.
Calymene niagarensis Hall, 18th Rept. N. Y. state cab. nat. hist., 1865, p. 30, adv. sheets; 20th Rept. N. Y. state cab. nat. hist., 1868, p. 334; 1870, rev. ed., p. 425. Weller, Bull. Chicago acad. sci., no. 4, pt. 2, p. 261, pl. 23, f. 9–10.

One of the most abundant of the trilobites of the Chicago area and of southeastern Wisconsin is a Calymene which is constantly identified as *C. niagarensis*. It is quite commonly found entire, but always so far as I have seen in the condition of a cast of the interior. Moulds of the exterior are common, but seldom complete.

The cephalon is like that of *C. niagarensis*, with a short lip and narrow furrow in front of the glabella. The dorsal furrows are always very deep and sharp, but this is due to the state of preservation. The glabella tapers rather abruptly toward the front. The basal lobes are large, rounded, almost isolated; the second lobes small and rounded, the intermediate "extra lobes" not very prominent. The third lobes are very small and the fourth ones just barely indicated. The frontal lobe is short and rather square at the front. The eyes are close to the glabella and opposite the furrows between the second and third pairs of lobes.

The pygidium is the most characteristic portion of the animal. The axial lobe is narrow, well defined, and has rings. The pleural lobes show four pairs of narrow ribs, without impressed line, which reach only halfway to the margin. The fourth of the four pairs are very faint and short. Each pleural lobe is thus divided into a small triangular ribbed portion near the axial lobe and a much longer smooth portion below. This pygidium presents the greatest possible contrast to *C. niagarensis,* in which the ribs are more conspicuous near the margin than near the axial lobe. The peculiarities of the pygidium have doubtless been noticed before, and probably have been explained as due to the state of preservation, the specimens all being internal casts. Internal casts of either cephala or pygidia of trilobites are practically always less and not more smooth than the exteriors, however, and cleaned interiors of *C. senaria, C. breviceps,* and *C. meeki,* all show that Calymene follows the general rule. *Calymene celebra* shows a halfway stage to what is achieved in *C. clintoni* Vanuxem, namely, a pygidium with smooth pleural lobes. The latter species is too far removed from the Calymenes with typical ribbed pygidia to be included in the same genus.

Formation and locality: — *Calymene celebra* is common in the Niagaran of the Chicago district in northern Illinois, in the same portion of the Silurian in southeastern Wisconsin, and also near Madison, Indiana, and Eaton, Ohio.

LIOCALYMENE, gen. nov.

Calymeninae (as distinguished from the Homalonotinae) with distinct glabella, three pairs of glabellar lobes, narrow thorax, pygidium with ringed axial and smooth pleural lobes. Type, *Hemicrypturus clintoni* Vanuxem.

Liocalymene clintoni, in perfect preservation, appears to be an exceedingly rare fossil. The single specimen in the M. C. Z. is in about the same condition as that figured by Hall (Pal. N. Y., **2**, p. 298, pl. A 66, f. 5a), and is from the Clinton shale at Clinton, Herkimer Co., N. Y.

CHEIRURIDAE Salter.

Cheirurinae Raymond.

Cheirurus niagarensis (Hall).

Plate **4**, fig. 4, 5, 6, 9.

Ceraurus insignis Hall, Pal. N. Y., 1852, **2**, p. 303, pl. 67, f. 9, 10.

Ceraurus niagarensis Hall, 20th Rept. N. Y. state cab. nat. hist., 1868, p. 376. ? Whiteaves, Geol. surv. Canada. Pal. foss., 1884, **3**, pt. 1, p. 42; 1895, **3**, pt. 2, p. 107. ? Van Ingen, School of mines quarterly, Columbia univ , 1901, 23, p. 35 (no description). Kindle, 28th Ann. rept. Dept. geol. and nat. res. Indiana, p. 483, pl. 23, f. 1, 2, pl. 24, f. 8. Weller, Bull. Chicago acad. sci., 1907, no. 4, pt. 2, p. 263, pl. 24, f. 20, non 21.

The name *Ceraurus niagarensis* appears for the first time on p. 376 of the first edition (1868) of the 20th Ann. Rept. of the New York State Cabinet of Natural History. Earlier in the same paper, (p. 335), Hall referred certain trilobites from the Silurian at Wauwatosa and other localities in Wisconsin to *Ceraurus insignis* (Beyrich). On p. 376 he states that he has reexamined the specimens and considers them different from *C. insignis*. The name *Ceraurus niagarensis* is used as a heading, but is not designated either as a new name or a new species. On p. 427 of the Revised edition, published in 1870, the remarks are reprinted, but the letters N.S. follow the name. In neither case is there any description of the species given, but the plates contain representations of an imperfect cranidium and a broken hypostoma.

The next use of the name by Hall was in 1879, in the 28th Rept. of the N. Y. State Museum, p. 189. He here describes the pygidium at some length from specimens obtained at Waldron, Indiana, and remarks, at the end of his description: "From the above it will be seen that the separation first made in the revised edition of the 20th Rept. St. Cab., was necessary, and that it constitutes a distinct species." The single figure given represents a pygidium.

After studying collections from a number of localities it becomes evident that the American forms now referred to *Ceraurus niagarensis* include two or three species, and it is therefore, necessary to determine the type for *C. niagarensis*. From the absence of description accompanying the first use of the name *niagarensis* it would appear that Hall did not apply the name to the Wisconsin specimens alone, but meant to assign this name to all American forms previously ascribed to *Cheirurus insignis* or *Ch. bimucronatus.* This idea is strengthened by the fact that he states that the New York and Wisconsin specimens show the same characteristics. He also refers to Roemer's *Ceraurus bimucronatus* from Tennessee. This idea is still further strengthened by the remark quoted above from his description of the Waldron fauna. If this is the case, then we should return to Hall's first description of a *Ceraurus insignis* in America to get at his idea of the species. If we take the other view, that the specimens from Wauwatosa, which seem to have been the first ones to cause Hall to doubt the correctness of his reference of all the Silurian cheirurids to the Bohemian species, are the real types of *C. niagarensis,* we are confronted by the fact that he did not describe his specimens, and, moreover, he was evidently in doubt about them, as evidenced by his pleasure at finding distinguishing features in the pygidia from Waldron. This latter description was the first real description published after the name *niagarensis* was proposed, and it might well be argued that the last described of the group should be the type. It seems simpler, however, to accept what was Hall's evident intent, and believe that in proposing the name *niagarensis* he was merely proposing a new name for the specimens he had previously described as *Ceraurus insignis.*

The first description of *Ceraurus insignis* Beyrich, by Hall occurs in vol. 2 of the New York State Paleontology, 1852. On page 300 there is mentioned, without description, a glabella from the Clinton which is figured on plate 66A. On page 306 of the same volume Hall describes two cranidia from the Rochester shale at Rochester, N. Y. Both specimens are figured. As these are the first American specimens which are both figured and described, I propose to designate as the type of *Cheirurus niagarensis* (Hall) the one represented in fig. 10, pl. 67, of the above volume. This specimen is in the American Museum Natural History, No. 1827.

The specimen so designated is a typical Cheirurus, with the glabella expanding rather rapidly forward, the frontal lobe occupying less than half the length of the glabella, and the first two pairs of glabellar furrows nearly straight, and following a direction approximately parallel to the posterior margin of the cephalon. Their inner ends are separated by a smooth space equal in width to about half the glabella. The eyes are near the dorsal furrows, and about opposite the second glabellar furrows.

This type of cranidium is quite often seen in collections from the Rochester shales, but one also sees another type, the one which Hall figured from the Clinton. The cranidium is similar to the one just described, but the glabellar furrows, instead of being short and straight, are long, curve backward, and their inner ends almost meet. This type of head deserves to be recognized as distinct from the other; it is the type of head figured by Hall from Wisconsin and though both types are very common there, this is by far the more abundant. To this same type, though possibly not to the same species, belongs the cephalon of *Ceraurus bimucronatus* figured by Roemer.

No entire specimen of Cheirurus has, so far as I know, been found in America, and it is therefore difficult to decide what pygidium shall be associated with each type of cephalon. It would appear that no Cheirurus pygidium had been figured from New York. The M. C. Z. possesses a single small pygidium of a Cheirurus from the Rochester shale at Rochester, N. Y. It is of the familiar *Cheirurus insignis* type, with three pairs of long slender spines, and a short median spine. It is very different from the pygidium from the Waldron shale ascribed to *Ceraurus niagarensis* by Hall, for that specimen was described as having broad flat spines, each spine with a depressed line on the surface.

Pygidia found at Wauwatosa are like the one from Rochester and it seems probable that this type of pygidium is to be referred to *Cheirurus niagarensis.*

The following description of *Cheirurus niagarensis* is based on three glabellas (M. C. Z. 325) and a pygidium (M. C. Z. 324) from the Rochester shale at Rochester, N. Y., and a cranidium with three segments attached and an associated hypostoma, from Wauwatosa, Wisc. (M. C. Z. 626). A large cranidium with a part of the thorax (M. C. Z. 627) from Wauwatosa was also consulted.

CHEIRURUS NIAGARENSIS (Hall) *restricted.*

A Cheirurus of medium size. Cranidium semicircular in outline, gently convex, the glabella forming the highest and most prominent part, but not standing much above the cheeks. The glabella reaches the front of the cranidium, expands toward the front, and is widest at the middle of the frontal lobe. Dorsal furrows narrow and sharp, but not very deep. Glabellar furrows short, sharp, the first two pairs extending only a short distance onto the glabella. Their direction is approximately vertical to the axis of the animal, but they are usually not absolutely straight, but bend a little forward in mid length. The posterior furrows run diagonally inward and connect with the neck furrow, as in the genus generally. The eyes are close to the glabella and opposite the second pair of glabellar furrows. Free cheeks small, pitted, with a smooth, convex rim. Fixed cheeks pitted. Glabella granulose. The associated hypostoma is roughly tetragonal, the surface with sharp, scattered pustules, and the posterior margin nearly straight, without spines at the angles. The furrow around the body portion is wide and deep.

Of the thorax only three segments are known. The axial lobe is narrow, the inner part of the pleural lobe is crossed by a narrow diagonal furrow which separates two triangular nodes, and there is a prominent node at the fulcrum. Beyond the fulcrum the pleuron projects as a blade-like spine.

The pygidium is short, with three pairs of slender spines which are oval in section and unfurrowed. The last pair extend further back than the ones ahead of them. A median spine is present, but very short. The axial lobe is narrow, cone-shaped, with the point backward, bearing three rings and a node. The pleural lobes are narrow, and show a single short divided rib on either side at the anterior end.

This species is very much like *Cheirurus insignis* Beyrich. The glabella seems to be a little shorter and wider in the American form, and the Bohemian species has the eyes further from the glabella and has eyelines. Of the latter, however, the specimens in the M. C. Z. show a trace. The hypostoma of the Bohemian form is similar to that of the American species, but the posterior margin is somewhat wider and more flattened. The pygidia are practically the same, though the median spine is a little stronger in *Ch. insignis*.

It will be seen from the above description, that if we restrict *Cheirurus niagarensis* to those forms which Hall first identified with *Cheirurus insignis*, we eliminate both the forms which caused him to change his mind about the identification, and propose the new name *niagarensis*. This would seem to vitiate the argument above, but it must be remembered that Hall did not recognize that he was dealing with more than one species, and he did not apply the new name to any definite specimens. In fact, it would seem that he did not become fully convinced that a new name was needed till he studied the pygidium from Waldron, and if the name *niagarensis* is not to be interpreted as has been done here, it would be almost impossible to decide whether the Wisconsin or the Waldron specimens should be selected as the types.

In spite of the similarity of *Cheirurus niagarensis*, as above defined, to *Cheirurus insignis*, I believe that a separate specific name should be maintained, especially as the discovery of further material may show unsuspected differences between the two.

Measurements: — A cranidium from Rochester (M. C. Z. 625). Length 20 mm., width 35 mm.; width of glabella at neck-ring 12 mm., at front 16 mm.; length of frontal lobe 10 mm. A cranidium from Wauwatosa, (M. C. Z. 626). Length 9 mm., width 18 mm.; width glabella at neck-ring 5 mm., width at front 8 mm.; length of frontal lobe, 3 mm.

Formation and locality: — Rochester shale at Rochester and Lockport, N. Y., Niagaran in Indiana, Wisconsin and Illinois.

CHEIRURUS WELLERI, sp. nov.

Plate **3**, fig. 6; Plate **4**, fig. 7, 8, 10.

Ceraurus insignis Hall, Pal. N. Y., 1852, pt. 2, p. 300, pl. 66A, f. 4. Geol. surv. Wisc., 1862, **1**, p. 433; 18th Rept. N. Y. state cab. nat. hist., 1865, p. 31, adv. sheets; 20th Rept. N. Y. state cab. nat. hist., 1868, p. 335.

? *Ceraurus bimucronatus* Roemer, Silurian faun. west. Tenn, 1860, p. 80, pl. 5, f. 19.

Ceraurus niagarensis Hall, 20th Rept. N. Y. state cab. nat. hist., 1868, p. 376, pl. 21, f. 10–11; 1870, rev. ed., p. 427, pl. 21, f. 10, 11; 11th Rept. Dept. Geol. and nat. hist. Indiana, pl. 33, f. 10, *non* pl. 34, f. 16. Weller, Bull. Chicago sci., 1907, no. 4, pt. 2, pl. 24, f. 21 (non 20).

The most abundant American Silurian cheirurid in the collections of the M. C. Z. is one whose glabellar furrows nearly cross the glabella, and is therefore the nearest approach to a Crotalocephalus so far found in America. This type has long been known, but constantly confused with *Ch. niagarensis* or *Ch. insignis*. As has already been mentioned, Hall figured one in 1852, and Roemer a similar one in 1860. The two species sometimes occur together, as at Wauwatosa, but *Ch. welleri* is easily recognized by its long glabellar furrows. A second distinction is that the posterior margin of the hypostoma is rounded in *Ch. welleri* and straight in *Ch. niagarensis*. Further, the hypostoma of the latter species is tuberculated and of the former smooth.

A large Cheirurus with approximately semicircular cephalon. The glabella is long, expands gradually forward. The frontal lobe occupies less than half the length, and the furrows are long, curve backward, the last pair meeting, as usual, and the inner ends of the other pairs being very close together. The free cheeks are small, the eyes opposite the ends of the second pair of glabellar furrows and near the dorsal furrows. The fixed cheeks are wide, with coarse pits, and the genal spines are short and slender. The glabella seems to be devoid of granulation.

Of the thorax, only five segments have been seen. It seems to be in all respects like that of *Ch. niagarensis*. No pygidium can definitely be assigned to this species. All the specimens found at Wauwatosa seem to agree with the pygidium from Rochester which has been assigned to *Ch. niagarensis*. Weller has, however, figured a cheirurid pygidium found near Chicago, in which the central spines of the pygidium are shorter than the others. This pygidium is in this respect unlike the one here assigned to *Ch. niagarensis* and may belong to *Ch. welleri*. In cephalon and thorax, *Ch. welleri* is closely allied to *Ch. quenstedti* Barrande, of Bohemia. This species has the inner spines so short that the pygidium appears to possess only two pairs of spines. It may be that *Ch. welleri* has a pygidium intermediate in form between *Ch. insignis* or *Ch. niagarensis*, and *Ch. quenstedti*.

Measurements: — A large cranidium, one of the cotypes (M. C. Z. 14) is 33 mm. long and 62 mm. wide; the glabella is 19 mm. wide at the neck-ring and 25 mm. wide at the frontal lobe; the frontal lobe is 15 mm. long. This has about the same length as *Ch. dilatatus*, but the disparity of the other dimensions should be noted. The figures for *Ch. welleri* are always given first. Length, 33, 35, width, 62, 52; width glabella at neck, 19, 20, at frontal lobe, 25, 31. The longer specimen is the narrower, and has a wider glabella, thus showing a great reduction of the cheeks. The cranidium of a smaller cotype (M. C. Z. 630) is 14.5 mm. long, 25 mm. wide, the glabella is 7 mm. wide at the neck-ring, 11 mm. wide at the frontal lobe, and the frontal lobe is 7 mm. long. Large specimens of this species seem to have been abundant, and the largest glabella in the collection is 45 mm. long, and, so far as I know, the largest American cheirurid. Restored with the proportions of *Ch. insignis*, this trilobite would have a length of 145 mm. or nearly 6 inches. The Bohemian *Eccoptochile claviger* (Beyrich) equals this size.

Formation and locality: — The types are from the Niagaran at Wauwatosa, Wisc. The species occurs also in the Clinton of New York, the Waldron of Indiana, Silurian of Tennessee, and Guelph of Ontario. It is probably the most cosmopolitan species of Cheirurus.

CHEIRURUS DILATATUS, sp. nov.

Plate **4**, fig. 1, 3.

Sphaerexochus romingeri ? Hall, 28th Rept. N. Y. state mus. nat. hist., 1877, doc. ed., pl. 32, f. 16.

Ceraurus (Cheirurus) niagarensis Hall, 28th Rept. N. Y. state mus. nat. hist., 1879, mus. ed., p. 189, pl. 32, f. 16; 11th Ann. rept. Dept. geol. and nat. hist. Indiana, 1882, p. 335, pl. 34, f. 16, *non* pl. 33, f. 10.

In the discussion of *Cheirurus niagarensis* (p. 30) frequent mention has been made of the pygidium from Waldron which Hall figured. This pygidium differs radically from the pygidia which have been referred to *Ch. niagarensis* and *Ch. welleri,* in having broad, short spines, each marked by a depressed line. This appearance of the spines is probably due to crushing, in so far as the depressed line is concerned, but the spines are decidedly shorter and broader than those of the species previously described.

Cheirurids seem to be rare at Waldron for a search through an extensive collection from that locality in the M. C. Z. has revealed only one good cranidium, one poor one, and a pygidium. The best specimen is a fairly well-preserved cranidium, having much the general appearance of *Ch. niagarensis,* only larger. On a closer examination of the proportions, however, it is seen that this form is longer and narrower than the typical specimens of *Ch. niagarensis,* and the glabella makes up a larger proportion of the cephalon. In a specimen of *Ch. niagarensis* from Rochester (M. C. Z. 625) the length is .57 of the width and in the specimen from Waldron (M. C. Z. 628) it is .67. In the first species the width of the frontal lobe of the glabella is less than half the width of the cephalon (.46). In the latter specimen it is somewhat more (.60). These appear, in figures, relatively small differences, but when the areas involved are compared it is at once seen that the glabella of the Waldron specimen is much larger than that of the specimens of *Ch. niagarensis.*

It is of course uncertain whether the pygidium described by Hall is to be associated with the cranidium here discussed. It may belong to the same species, and they are provisionally associated. The cranidium is, however, made the holotype of the species, and the pygidium a paratype.

A large Cheirurus. The cranidium is dominated by the glabella, whose frontal lobe is more than one half as wide as the total width of the head. The glabella expands rapidly forward, the frontal lobe occupies less than one half the length, and the glabellar furrows are like those of *Cheirurus niagarensis.* The free cheeks are small, the eyes opposite the ends of the second pair of furrows, and a little further from the glabella than in *Ch. niagarensis.* The surface of the cheeks shows numerous pits, while the glabella is granulose. Genal spine rather long and straight.

Only one kind of Cheirurus pygidium has been found at Waldron. The spines are short and subequal in length, broad, and flat. The ribs on the pleural lobes are distinctly separated by furrows, and the first rib on each side has a short sharp diagonal furrow. The median unpaired spine at the back is about one half as long as the ones adjacent to it.

Measurements: — The type is 35 mm. long, 52 mm. wide; the glabella is 31 mm. wide at the front and 20 mm. wide at the neck-ring; the frontal lobe is 17 mm. long.

Formation and locality: — Found only in the Waldron shale at Waldron, Indiana.

CHEIRURUS PATENS, sp. nov.

Plate 4, fig. 2.

This species, like the previous one, is notable for the small size of its cheeks. The glabella is of the *insignis* type, with short furrows, but is rather more convex and prominent than in that species. It expands rapidly toward the front, and the frontal lobe is a little longer than in any other species of the genus, forming a trifle more than one half the length of the glabella of the type. The outline of the frontal lobe is almost exactly semicircular, and thus differs from most of the other specimens seen, the ordinary outline being that of half an ellipse. Since the first pair of glabellar furrows are a little further back than on most species, the fixed cheeks which terminate here are shorter than usual, and the eye is a little further back.

The cheeks are full of pits, and the glabella granulose. The posterior glabellar lobes are not strictly triangular but pentagonal, a statement which is true of most species of Cheirurus, but more obvious than usual in this species.

Measurements: — Length about 31 mm., width, about 53 mm.; width glabella at frontal lobe 26 mm., length frontal lobe 17 mm.

Formation and locality: — The type is a single imperfect cranidium from the "Niagara" at Cicero, Illinois (M. C. Z. 629). A second specimen, tentatively referred to this species, is in the Museum of the Geological Survey of Canada, and is from the Guelph of Hespeler, Ontario.

CHEIRURUS TARQUINIUS Billings.

Cheirurus tarquinius Billings, Proc. Portland soc. nat. hist., 1863, **1**, p. **121**, pl. 3, f. 22.

This is a little-known species of the *Ch. insignis* group. It has a short, wide cephalon, narrow triangular basal lobes on the glabella, a short frontal lobe, and the first two pairs of furrows turn backward, are quite straight, and are intermediate in length between those of *Ch. niagarensis* and *Ch. welleri*. The species is especially characterized by the forward position of the eyes, which are opposite the second glabellar lobes, and the consequent small free cheeks and long fixed cheeks. The genal angles appear to be spineless.

The type is No. 3081 in the Museum of the Geological Survey of Canada. Associated with it is a pygidium from the same locality. It is of the *insignis* type, with three pairs of spines, but the median spine is shorter and more rounded than in either *Ch. insignis* or *Ch. niagarensis*. A poorly preserved hypostoma in the same collection has the posterior end more rounded than that of *Ch. niagarensis*, and thus more like that of *Ch. welleri*.

Measurements: — The type (G. S. C. 3081) is 19 mm. long, 35 mm. wide; and the glabella is 12 mm. wide at the neck-ring and 17 mm. wide at the frontal lobe.

Formation and locality: — Middle Silurian at Port Daniel, Bay, Chaleur, P. Q., Canada. Also reported by Billings from Masardis, Maine.

CHEIRURUS HYDEI (Weller).

Ceraurus hydei Weller, Bull. Chicago acad. sci., 1907, no. 4, pt. 2, p. 264, pl. 24, f. 22.

This species is of more than ordinary interest, from its resemblance to a Ceraurus. The cephalon and thorax are those of a typical Cheirurus, but the pygidium is that of Ceraurus. This at once raises the question as to whether this is a Cheirurus which has developed a Ceraurus-like pygidium, or whether it is a Ceraurus whose cephalon and thorax have developed in a manner paralleling that of Cheirurus.

There is still a third possibility, namely, that *Ceraurus hydei* is the young of *Cheirurus niagarensis*, with which it occurs. On this third point, Weller states that the fixed cheeks of *C. hydei* lack the pitted surface characterizing *C. niagarensis,* and that *C. hydei* has a border all around the cephalon, while *C. niagarensis* lacks it in front of the glabella. These facts seem to be borne out by the type which is now before me, and Professor Weller might have added that the glabella expand more rapidly in the young of *C. niagarensis* than in *C. hydei,* and has deeper glabellar furrows. The eyes too, of the young of *C. niagarensis* are much further back than those of *C. hydei.*

Against these differences we may, however, place the fact that the thorax is alike in the two species, and more similar to the thorax of *Cheirurus insignis* Beyrich than to any of the Ordovician species of Ceraurus. In both *Cheirurus niagarensis* and *Ceraurus hydei,* the part of each pleural lobe between the dorsal furrow and the fulcral line is very much reduced, the diagonal furrow is very short, and the two small nodes which it separates are narrow, and one directly in front of the other, a point not brought out in Weller's somewhat generalized figure. On the fulcral line there is a row of nodes, and just inside this row is a longitudinal furrow parallel to the dorsal furrows. Beyond the fulcral line, the pleura are free, not contiguous as shown in Weller's figure. These same characteristics are shown in two specimens of *Cheirurus niagarensis* from Wauwatosa, Wisconsin.

On the whole, it does not seem very probable that *C. hydei* is the young of *Cheirurus niagarensis,* especially as there is another species, *Ceraurus nuperus* (Billings) which has a Cheirurus-like cephalon and Ceraurus-like pygidium. The choice seems to lie between calling it a Ceraurus or a Cheirurus. Theoretically, it would seem that the Ceraurus pygidium was more specialized, and, therefore, less apt to be duplicated than the Cheirurus head. Most of the other Cheiruridae, except Ceraurus, have all the spines of the pygidium approximately equal.

In *Ceraurus pleurexanthemus* there is a tendency in some specimens to have the basal lobes of the glabella triangular instead of square, and in *Ceraurus misneri* the glabella occupies a large part of the cephalon, and the cephalon is long. Further, Ceraurus reaches the climax of size and abundance in the Trenton, the late species being smaller, and the specimens rarer. As to the thorax, I have shown that this portion of the test changes in parallel directions in many lines of the Asaphidae, and the same might well happen in the Cheirurudae. On the other hand, one would not expect a decadent race to show new characters similar to those of a race which is at its best.

Though no other cheirurid exactly duplicates the Ceraurus pygidium, there are numerous cases among the trilobites referred to the genus Cheirurus in which there is a reduction of the inner pairs of spines of the pygidium. Thus, Weller has figured a Cheirurus pygidium from Lemont, near Chicago, in which spines of the inner pair are shorter than the others. In *Cheirurus quenstedti* there are only two pairs of spines, the inner pair being reduced to mere rudiments. In *Cheirurus hawlei* there is a still further reduction, so that there is only one pair of long spines, thus producing a pygidium which is a parallel to that of Ceraurus, though differing considerably from it in detail. The typical number of segments in a Cheirurus pygidium seems to be five, a protopygidium and four pairs of coalesced segments which originally had free spines. Among the species referred to Cheirurus by Barrande may be seen *Ch. minutus* Barrande with four pairs of spines, *Ch. bifurcatus* with four pairs, the central pair partly united, *Ch. insignis* and many others with three pairs and a central spine. In England, *Ch. bimucronatus* with three pairs without the central spine. In Bohemia again, *Ch. quenstedti* Barrande with two pairs of spines and two rudiments, *Ch. hawlei* Barrande with one pair spines and four rudiments, and in America *Ch. hydei* Weller and *Ch. nuperus* Billings with one pair of spines and three rudiments. Differences in the cephalon show that this is not a progressive (or regressive) series, but apparently a number of cases of parallel development by the loss of the posterior inner pairs of spines.

In view of this general tendency among the cheirurids to a reduction of the spines of the pygidium, it seems that more weight should be given to the cephalon then to the pygidium in determining relationships, and *Ch. hydei* and *Ch. nuperus* are therefore referred to Cheirurus. It may be proper, when the family has been more fully studied, to erect a new genus for these peculiar species. The M. C. Z. has recently acquired a fairly complete specimen (M. C. Z. 631) of this species, of which only two other specimens are now known. The specimen is from an unknown locality near Chicago, Ill. This specimen shows that the eye is very far forward, opposite the first pair of glabellar furrows. Both the genal and pygidial spines are longer than had been supposed, and as pointed out above, the pleura of the thorax, beyond the line of nodes denoting the fulcra, are free blade-like spines.

Measurements: — The specimen figured by Weller is 24 mm. long, 14.5 mm. wide at the genal angles, and the glabella is 5 mm. wide at the back.

Formation and locality: — Known only from the Niagaran near Chicago, Illinois.

CHEIRURUS NUPERUS Billings.

Cheirurus nuperus Billings, Cat. Silurian fossils Anticosti, 1866, p. 60, f. 20.

This species was described from an isolated glabella and pygidium from Div. 3 at East Point, Anticosti. Schuchert and Twenhofel have listed it with a query from the upper part (D9) of their Gun River formation, where it is associated with *Bilobites bilobus* and *Triplecia ortoni*, in strata of Clinton age.

Like *Ch. hydei*, this species shows the Cheirurus type of basal lobes on the glabella and the pygidium shows three pairs of spines. The outer pair or great spines are large, flat and not so long or so much curved as in most of the species of the genus. *C. hydei* has the great spines much more slender and further apart than in *C. nuperus*.

The type of this species is lost, and no further specimens have been described.

SPHAEREXOCHUS ROMINGERI Hall.

Sphaerexochus romingeri Hall, 20th Rept. N. Y. state cab. nat. hist., 1868, p. 375, pl. 21, f. 4–7. (See Weller, Bull. Chicago acad. sci., 1907, no. 4, pt. 2, p. 209, for earlier and later references to this species).

This is an exceedingly common species in the Niagaran in the Chicago and Wisconsin areas but the pygidium is rare and usually incorrectly figured. Hall started the misrepresentation figuring the pygidium as having three spines on each side and a rounded projection at the back.

As a matter of fact, the margin of the pygidium is entire, and the spines figured by Hall are the ribs on the pleural lobes. Weller produced practically a similar figure, and one of Kindle's is about the same, but the other, being of a mould, is more correct. Other describers of the species have refrained from figuring the pygidium.

PLATE 1.

PLATE 1.

All figures natural size.

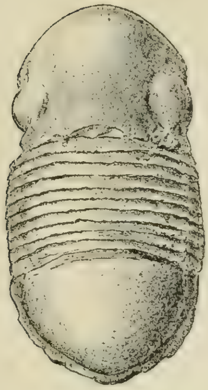
1. *Bumastus decipiens* Raymond. A specimen lacking the free cheeks and with the posterior portion of the pygidium incomplete. Niagaran at Wauwatosa, Wisc. M. C. Z. 641.
2. The same species. Side view of the holotype, showing the large eye and the absence of lip on the free cheek. Wauwatosa, Wisc. M. C. Z. 642.
3. *Bumastus niagarensis* (Whitfield). An entire specimen. Wauwatosa, Wisc. M. C. Z. 643.

4, 5. *Actinolobus americanus* Raymond. Two views of the holotype. From the Racine dolomite (Niagaran), Racine, Wisc. M. C. Z. 644.

6, 7. *Bumastus tenuis* Raymond. Two cranidia, to show the flattened form and the wide concave lip. Wauwatosa, Wisc. M. C. Z. 645, 646.

8, 9. *Bumastus dayi* Raymond. Dorsal and side views of the holotype. Wauwatosa, Wisc. M. C. Z. 647.

10. The same species. A large cephalon. Wauwatosa, Wisc. M. C. Z. 648.
11. *Bumastus tenuis* ? Raymond. A pygidium referred with doubt to this species. Wauwatosa, Wisc. M. C. Z. 649.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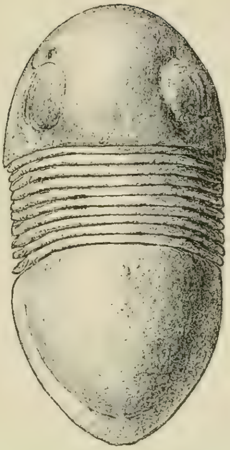
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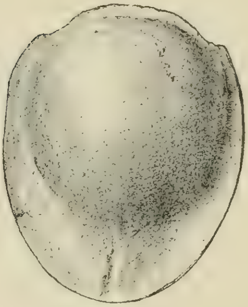
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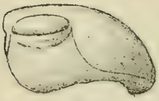
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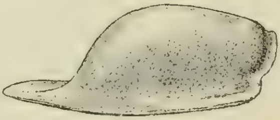
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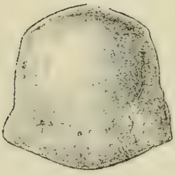
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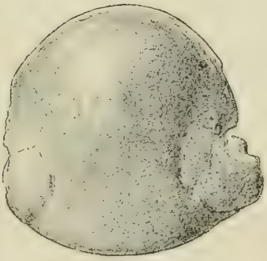
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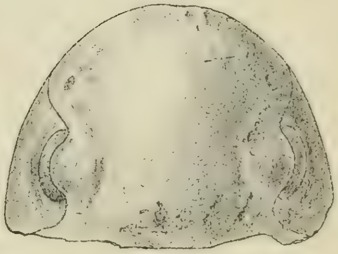
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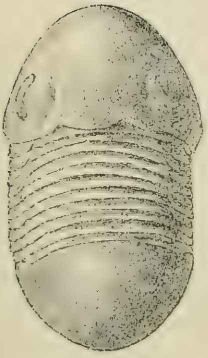
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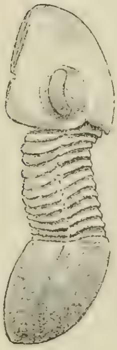
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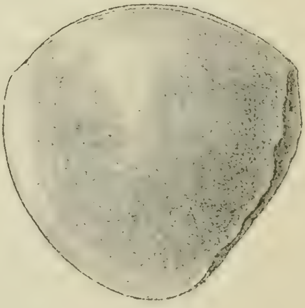
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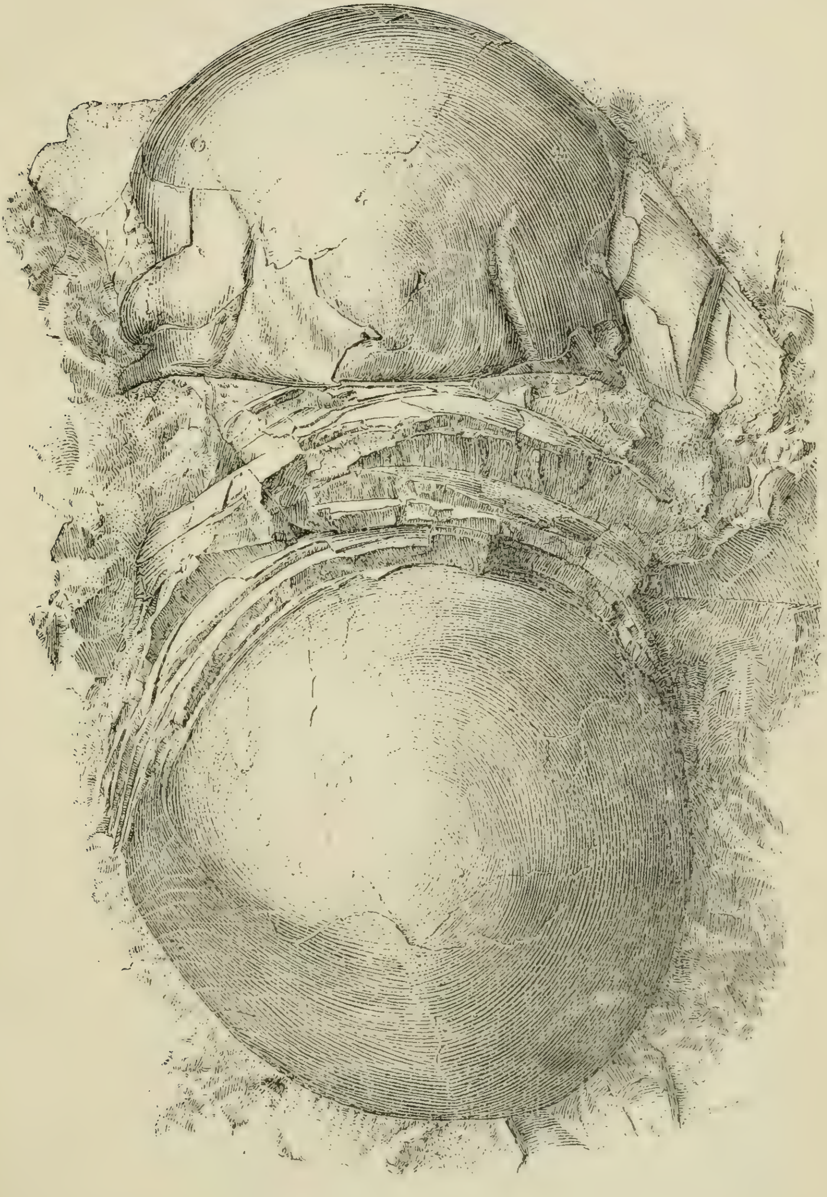
PLATE 2.

PLATE 2.

Bumastus indeterminatus (Walcott). The holotype. From the Leray-Black River at Newport, Herkimer Co., N. Y. Natural size. M. C. Z. 650.



E. N. FISCHER, DEL.

PLATE 3.

PLATE 3.

All figures natural size.

1, 2. *Trochurus nasutus* (Weller). Dorsal and side views of a cranidium from the Niagaran at Wauwatosa, Wisc. M. C. Z. 632.

3. *Ceratocephala goniata* Warder. Mould of the exterior of a pygidium. From the Racine dolomite, Racine, Wisc. M. C. Z. 633.

4. The same species. A fragment of a thorax. Racine, Wisc. M. C. Z. 634.

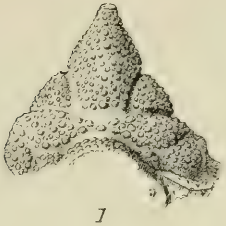
5. The same species. A natural cast of the central part of a pygidium. Racine, Wisc. M. C. Z. 635.

6. *Cheirurus welleri* Raymond. A cephalon and parts of five thoracic segments. Wauwatosa, Wisc. M. C. Z. 630.

7, 8. *Encrinurus reflexus* Raymond. Dorsal view of one, and profile view of the other of the cotypes. From the Niagaran at Wauwatosa, Wisc. M. C. Z. 636, 637.

9, 10. *Calymene celebra* Raymond. The cephalon of one entire specimen and the pygidium of another, the two specimens being the cotypes of the species. From the Niagaran at Grafton, Illinois. M. C. Z. 638, 639.

11. *Calymene breviceps* Raymond. An entire specimen from the Waldron shale (Silurian), at Waldron, Indiana. Holotype. M. C. Z. 640.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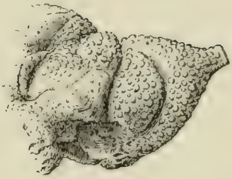
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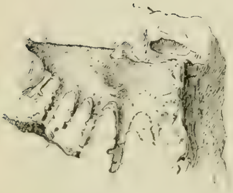
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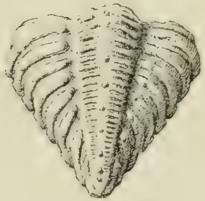
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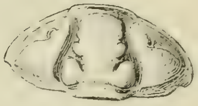
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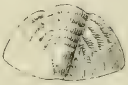
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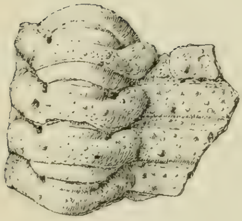
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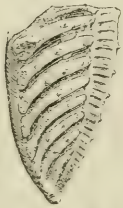
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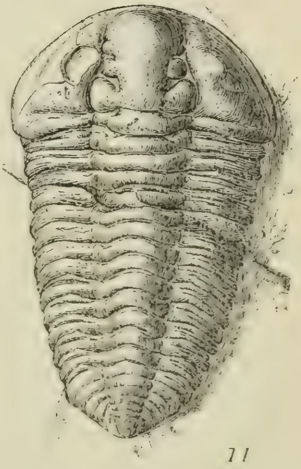
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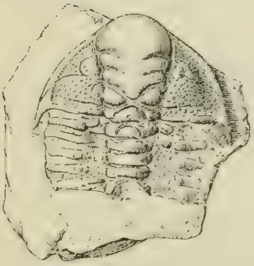
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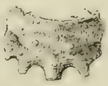
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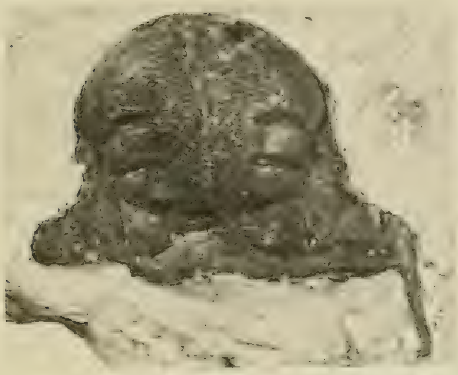
HELIOTYPE CO., BOSTON.

PLATE 4.

PLATE 4.

1. *Cheirurus dilitatus* Raymond. The holotype. From the Waldron shale, Waldron, Indiana. Natural size. M. C. Z. 628.
2. *Cheirurus patens* Raymond. The holotype. From the Niagaran at Cicero, Illinois. Natural size. M. C. Z. 629.
3. *Cheirurus dilatatus* Raymond. A pygidium from the Waldron shale. × 2. M. C. Z. 1273.
4. *Cheirurus niagarensis* Hall. Cephalon and part of thorax from Wauwatosa, Wisc. Natural size. M. C. Z. 627.
5. The same species. A pygidium from the Rochester shale at Rochester, N. Y. × 3.4. M. C. Z. 624.
6. The same species. An hypostoma from Wauwatosa, Wisc. Natural size. M. C. Z. 1278.
7. *Cheirurus welleri* Raymond. A cotype. Wauwatosa, Wisc. Natural size. M. C. Z. 14.
8. The same species. The other cotype. The same specimen is shown in Plate **3**, fig. 6. Wauwatosa, Wisc. × $\frac{4}{3}$. M. C. Z. 630.
9. *Cheirurus niagarensis* Hall. A pygidium from Wauwatosa, Wisc. × 2. M. C. Z. 1277.
10. *Cheirurus welleri* Raymond. An hypostoma. Wauwatosa, Wisc. The specimen is attached to a glabella. × 1.45. M. C. Z. 1269.



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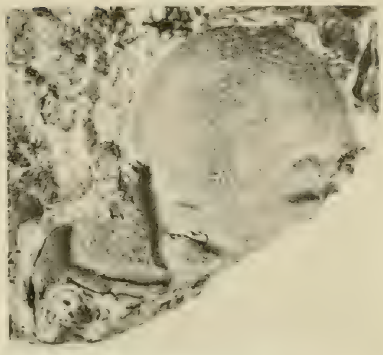

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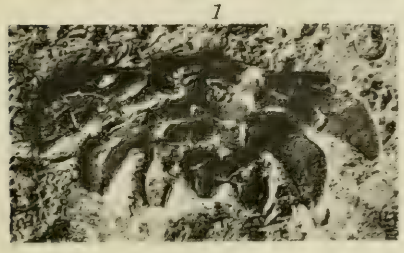

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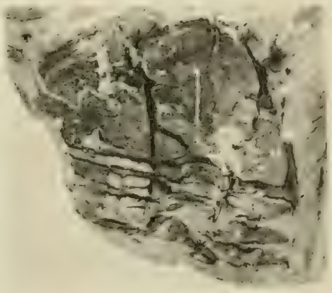

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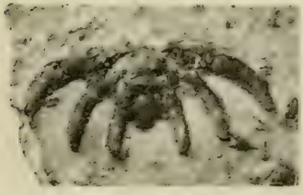

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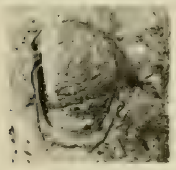

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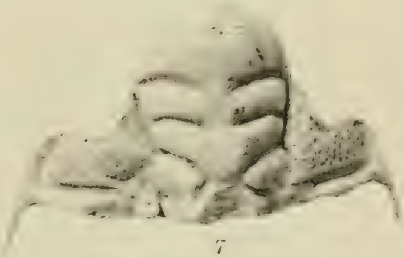

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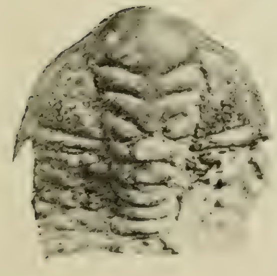

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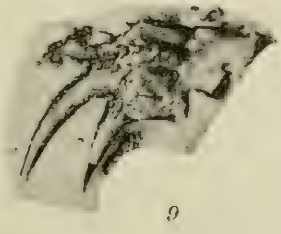

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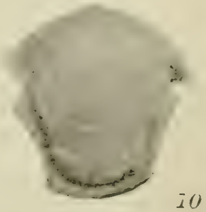

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GEORGE NELSON. PHOTO.

HELIOTYPE CO., BOSTON.

Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. LX. No. 2.

THE AUSTRALIAN ANTS OF THE GENUS ONYCHOMYRMEX.

By William Morton Wheeler.

With Two Plates.

CAMBRIDGE, MASS., U. S. A.:
PRINTED FOR THE MUSEUM.
January, 1916.

No. 2.— *The Australian Ants of the Genus Onychomyrmex.*

CONTRIBUTIONS FROM THE ENTOMOLOGICAL LABORATORY OF THE BUSSEY INSTITUTION, HARVARD UNIVERSITY. NO. 104.

By William Morton Wheeler.

Twenty years ago Emery described a singular ponerine ant taken by Podenzana on Mt. Bellenden-Ker, in Queensland, as the type of a new genus under the name of *Onychomyrmex hedleyi*, in honor of Mr. C. Hedley, a distinguished Australian naturalist. The worker, which was the only phase seen by Emery, exhibited an unusual combination of characters, especially in the shape of the mandibles, clypeus, petiole, and middle and hind tarsi, the terminal joints, pulvilli, and claws of which were conspicuously enlarged. He regarded the affinities of the genus as obscure. "Its mandibles and petiole," he says, "recall the species of Amblyopone and related genera, but the frontal carinae, approximated and dilated in front, resemble those of Ponera and Leptogenys. The tibiae without spurs are not found in any other Ponerinae. The tarsi, with their enormous claws and pulvilli, have no analogue, to my knowledge, except in the Dorylinae (*Aenictus, Anomma*), but the insertions of the antennae and the structure of the thorax lead me to think that these resemblances do not indicate a true relationship." Ashmead (Can. ent., 1905, **37**, p. 382) regarded the genus Onychomyrmex as constituting a distinct tribe of Ponerinae (Onychomyrmicini). In his recent revision of the subfamily in the "Genera Insectorum" (1911), Emery adopts Ashmead's name as that of a sixth and last subtribe in the tribe Ponerini.

While collecting in the rich tropical "scrub" in the neighborhood of Kuranda, Queensland during the autumn of 1914, I succeeded in finding not only *O. hedleyi*, which had not been recorded for nearly twenty years, but also two additional species of the genus. On returning to Boston I learned that Dr. E. Mjöberg had anticipated me in finding *O. hedleyi* and one of the other species, while he was collecting for the Swedish scientific expedition to Australia during 1910–1913 and that Forel had just described the latter as *O. mjöbergi*. The third species is described in the following pages as *O. doddi*, in honor of Mr. F. P. Dodd, the well-known observer and collector of Queensland insects. I was so fortunate as to discover the females of *mjöbergi* and *doddi* and the larva of the former species. The female Onychomyrmex is of such an unusual type that it seems advisable to revise the genus in such a way that some of my Australian friends may be able to recognize all the known species at a glance and to make additions to our knowledge concerning their habits.

Unfortunately the male Onychomyrmex is still unknown and will have to be found before the precise status of the genus in the subfamily Ponerinae can be ascertained. Forel does, indeed, describe a male ponerine taken by Mjöberg as that of *O. hedleyi*, but he says that he does this "with a very great interrogation point." He has, in fact, no evidence that the specimen is an Onychomyrmex, except the very inconclusive fact that it was taken in the same locality (Malanda, Queensland) as the worker of *hedleyi*. I deem it advisable, therefore, to assume that the male is unknown till it is actually taken in nests with the workers. Such observations as I was able to make on the habits of the three species of Onychomyrmex are recorded below in connection with the taxonomic descriptions. So far as at present known all the species of the genus are confined to Queensland, and all live in red rotten logs in the tropical rain-forest ("scrub").[1]

ONYCHOMYRMEX Emery.

Emery, Ann. Soc. ent. Belg., 1895, **39**, p. 349; Genera Insectorum, 1911, fasc. 118, p. 96; Forel, Arkiv. f. zoöl., 1915, **9**, p. 2.

Worker. Small, slender, monomorphic. Mandibles rather long, narrow at the base, broadest in the middle, with long, curved, acute tips, their inner borders armed with a number of unequal teeth, some of which, near the middle of the series, are directed backward. Both the maxillary and labial palpi very short, 2-jointed. Clypeus very short, abrupt, with rounded, entire anterior border beset with a regular row of minute teeth. Frontal carinae small, prominent, closely approximated, enlarged and dilated anteriorly, separated by a very narrow groove. Frontal groove lacking. Eyes very small, consisting of about 6 or 8 ommatidia, situated behind the middle of the head.

---

[1] Emery believed that the *Anomma erratica* of Frederick Smith from New Guinea might be an Onychomyrmex, but the description mentions none of the distinctive characters of this genus and was, perhaps, drawn from an Aenictus.

Antennae 12-jointed, funiculus filiform, not clavate or conspicuously enlarged at the tip. Thorax slender, with very distinct promesonotal and mesoëpinotal sutures; mesonotum small, discoidal, with distinct sutures on all sides. Petiole with a short peduncle in front and a large, prominent compressed ventral projection, the node rounded, scarcely narrowed behind where it articulates by means of its whole posterior surface with the postpetiole. Postpetiole large, convex below, separated by a pronounced constriction from the gaster, which is rather short. Sting very long and well-developed. Legs long; middle and hind tibiae without spurs; terminal joints of the middle and hind tarsi conspicuously elongated and incrassated, with very large, strongly curved, simple claws and large pulvilli.

Female. Apterous and ergatomorphic. Head broadened in front and more depressed at the anterior corners than in the worker. Eyes very small; ocelli absent. Mandibles more falcate, not abruptly curved at the tips, with only a few short, blunt teeth. Mesonotum somewhat longer than in the worker. Petiole differing from that of the worker in being much broader, with a very short and narrow peduncle and lacking the ventral projection. Constriction between the postpetiole and gaster much less distinct than in the worker. Gaster much larger, elongate elliptical, sting somewhat smaller. In other respects like the worker.

Larva. Slender, smooth and nontuberculate, with twelve very distinct postcephalic segments, the constrictions between which are everywhere deep and conspicuous, even at the posterior end of the body. Head short, rounded, with well-developed, slender, acute, falcate mandibles, destitute of teeth. Clypeus rather long, projecting. Antennae very small. Maxillary sensillae long and prominent. Head sparsely, remainder of body more densely and uniformly covered with short, straight, stiff hairs or bristles.

Genotype: *Onychomyrmex hedleyi* Emery.

The discovery of the ergatoid female of Onychomyrmex only adds to our perplexity in regard to the precise taxonomic position of the genus. Similar females are known to occur in a few other ponerine genera, notably in Acanthostichus, Paranomopone, which I recently described from Queensland, and Leptogenys (subgenus Lobopelta), but all of these, together with Onychomyrmex, belong to very different sections of the subfamily, and the resemblances between them seem to be due to "convergence" and not to morphological relationship, or common phylogenetic development. The thorax of the female has simply assumed the structure of that of the worker, while the gaster is greatly expanded to accommodate the voluminous ovaries. On closer examination it is found that in each of the four genera mentioned the female differs from the congeneric worker in certain peculiar characters. This will best be seen by a comparison of the worker and female Lobopelta with the corresponding phases of Onychomyrmex. Many years ago I called attention to the fact that the female *Lobopelta elongata* Buckley of Texas has no winged female, but that each colony contains a single egg-producing individual, which agrees in all respects with the worker, except in the larger size of the abdomen and the somewhat more compressed petiolar scale. While at Kuranda I succeeded in finding two females of another species (*Leptogenys* (*Lobopelta*) *fallax* Mayr subsp. *fortis* Forel), a small-eyed form which lives, like the species of Onychomyrmex, in red rotten logs in the primeval rain-forest. One of these females was the mother of a flourishing colony of perhaps 300 workers, the other was isolated in a small cavity in a large log and was, therefore, about to start a colony. I have figured one of the specimens (Plate **2**, fig. 8, 9), with the worker (fig. 6, 7) to show the difference between them (in this case greater than those obtaining between the female and worker of *Lobopelta elongata*) and between the corresponding phases of *Onychomyrmex mjöbergi* and *doddi* (Plate **1**, fig. 3–6; Plate **2**, fig. 3–5). It will be seen that in the Lobopelta female the petiole is very much more compressed and more curved forward than in the worker, the thorax more convex and furnished with a small scutellar sclerite and that the head is more orbicular and less rectangular and has distinctly larger eyes and a single ocellus. In the female Onychomyrmex the eyes are not larger than in the worker, there are no traces of ocelli, the head is dilated anteriorly, with rather straight, posteriorly converging sides, and with very different mandibles, while the petiole exhibits a peculiar modification as compared with that of Lobopelta, being greatly swollen behind and much contracted in front. The female Acanthostichus differs from the worker, according to Emery, in its rounded head, larger eyes, the presence of three ocellar pits, more widely separated frontal carinae, broader thorax, much larger abdomen, the absence of prickles on the sides of the pygidium, and a different pubescence on the abdomen. The only external differences between the female and worker Paranomopone are the presence of a median ocellus in the former and a larger postpetiole and gaster. These comparisons all point to the conclusion that in each of the four genera ergatomorphic females have been developed independently by simplification, or atrophy from the primitively winged type of female during the long phylogenetic history of the ponerine subfamily. It is also probable that the very similar "dichthadiiform" females of the ants belonging to the subfamily Dorylinae have had a like independent origin and development.

The larva of Onychomyrmex (Plate **1**, fig. 7; Plate **2**, fig. 1, 2), in the very distinct segmentation of the body and in the structure of the head, seems to be of a rather primitive type and resembles the larvae of the Dorylinae (Eciton) and lower Ponerinae (Acanthostichus, Cerapachys), but the larvae of ants have not been sufficiently studied to enable us to draw satisfactory conclusions concerning the phylogenetic relationships of the various genera.

A study of the worker Onychomyrmex certainly reveals a number of highly specialized characters. Such are particularly the shape of the mandibles, the vestigial condition of the palpi, the small size of the eyes, and the enlargement of the terminal joint, claws, and pulvilli of the middle and hind tarsi. The degenerate visual organs show that these ants belong to the hypogaeic series and that they pass their lives concealed in the logs which gradually decompose in the moist shade of the dense tropical jungle. The powerful, toothed mandibles, long sting and great hooked claws indicate that their possessors do not feed habitually on small feeble insects like termites, but on much larger creatures such as the larvae of passalids and scarabaeids and possibly on adult myriopods and scorpions. This I found to be the case in a colony of *O. mjöbergi*, for when the log containing it was broken open, many of the workers were detected in the act of biting and stinging to death a huge lamellicorn beetle larva more than two inches in length, which they had just found in a cavity in the wood. It is not improbable that the colonies move from place to place in search of their prey, like the colonies of the subterranean Dorylinae (*Eciton coecum* and Dorylus), which they very closely resemble in behavior, color, sculpture, and pilosity.

The species of Onychomyrmex are far from common even in Queensland, and the few colonies I secured were the reward of many hours of search and of the destruction of many old logs in places where I was frequently attacked by land-leeches and saw quite a number of the deadly black snakes (*Pseudechis porphyriacus*). Perhaps it would be possible for the collector to attract colonies by placing large beetle or cossid larvae in holes in the rotten logs usually found along the paths through the "scrub."

ONYCHOMYRMEX HEDLEYI Emery.

Plate **1**, fig. 1, 2.

Emery, Ann. Soc. ent. Belg., **39**, 1895, p. 350, f. 2. ☿; Gen. Insect., 1911, fasc. 118, p. 97, pl. 3, f. 9, 9*b*; Forel, Arkiv. f. zool., 1915, **9**, p. 3, pl. 1, f. 3 ☿ ♂ (?).

Worker. Length 3.5–4 mm.

Head about 1¼ times as long as broad, subrectangular, a little broader in front than behind, with straight sides and posterior border and rounded posterior corners. Clypeus with the anterior border slightly flattened, arcuately rounded in the middle, sinuate at the sides, its edge beset with about 20 minute, regular teeth. Eyes with about 6–8 minute ommatidia, situated ⅗ the length of the head from the anterior margin. Mandibles with long, abruptly incurved apical tooth and seven basal teeth of different sizes, the two in the middle of the series largest and directed backward. Antennae slender, scapes fully ⅘ as long as the head, first and last funicular joints twice as long as broad, remaining joints about 1½ times as long as broad. Thoracic sutures all strongly impressed; pronotum convex above, especially in front, with convex sides, a little longer than broad; mesonotum nearly twice as broad as long; epinotum longer and narrower than the pronotum, longer than broad, with feebly convex sides and separated in dorsal view from the pronotum by a pronounced impression on each side. In profile the thorax is distinctly impressed at the mesonotum, the base of the epinotum is nearly twice as long as the straight declivity into which it passes through an obtuse angle. Node of petiole in profile with rather straight anterior slope and convex summit, slightly concave at the posterior border; from above the node is as long as broad, rounded in front, with straight posterior border; ventral projection long and blunt, compressed and somewhat translucent. Postpetiole as long as broad, first gastric segment a little longer than the postpetiole. Legs slender.

Very smooth and shining; mandibles, clypeus, and cheeks subopaque, the mandibles finely striated, the clypeus and cheeks finely rugulose-punctate. Body with fine, sparse, piligerous punctures, which are most numerous on the head, especially on its sides.

Hairs delicate, pale yellowish, short, suberect, covering not only the whole body, legs, and antennal scapes but also the funiculi;

somewhat longer and sparser on the thorax, abdomen, and legs than on the head and antennae.

Black; thoracic sutures, sides and terminal segments of abdomen, clypeus, cheeks, and anterior portion of gula reddish castaneous, mandibles, except their teeth, antennae, and legs paler, brownish red, middle portions of femora and tibiae more or less infuscated.

Queensland: Mt. Bellenden-Ker, type locality (Podenzana); Malanda (E. Mjöberg); Kuranda (Wheeler and F. P. Dodd).

I took two small companies of this ant, unaccompanied by larvae or females, Oct. 24 and 28, evidently on foraging expeditions in the heart of rotten logs. One of the companies comprised a dozen, the other about two dozen workers. Later Mr. Dodd sent me eight workers which he had taken in the same locality. The ants moved rather slowly and were easily captured.

ONYCHOMYRMEX MJÖBERGI Forel.

Plate **1**, fig. 3–7; Plate **2**, fig. 1, 2.

Forel, Arkiv. f. Zool., 1915, **9**, p. 5, pl. **1**, f. 7; text fig. 1, ☿.

Worker. Length 3.5–4 mm.

Head subrectangular, not more than $\frac{1}{6}$ longer than broad, scarcely broader in front than behind, with feebly and evenly convex sides, feebly concave posterior border and rounded posterior corners. Clypeus with broadly arcuate anterior border, sinuate on each side, minutely and evenly denticulate. Eyes scarcely smaller than in *hedleyi*, situated about $\frac{2}{3}$ the distance from the anterior to the posterior border of the head. Mandibles similar to those of *hedleyi*. Antennae shorter, scapes only $\frac{2}{3}$ as long as the head, first and last funicular joints nearly twice as long as broad, remaining joints not longer than broad, the more basal joints a little broader than long. Thorax differing from that of *hedleyi* in being stouter and in having the dorsal outline nearly straight in profile, the pronotum being convex only at the extreme anterior end and the mesonotum less impressed. Thoracic sutures very distinct but less impressed than in *hedleyi*. Mesonotum fully three times as broad as long. Petiole with very short peduncle, anterior surface of node more concave, its upper surface seen from above distinctly broader than long, with very convex sides. Constriction between the postpetiole and gaster somewhat deeper than in *hedleyi*, legs stouter.

Smooth and shining; mandibles shining, not striate but sparsely punctate, like the remainder of the body. Punctures on the head coarser than in *hedleyi*, and more abundant, especially on the cheeks and sides of the front. Clypeus subopaque, rugulose-punctate.

Hairs similar to those of *hedleyi* but coarser and of rather uneven length, pale yellow.

Rich ferruginous red, clypeus darker; tarsal claws, sutures of thorax and gaster, articulations of antennal funiculi dark brown, mandibular teeth black; legs and anal segments of gaster paler and more yellowish.

Female. Length nearly 5.5 mm.

Head a little longer than broad and nearly as broad in front as long, with prominent, depressed anterior corners, the sides converging posteriorly, with two transverse impressions, one half-way between the anterior corner and the eye and one at the eye. Eyes as small as in the worker, but more elongate. Mandibles with less abruptly incurved tips than in the worker and with only two indistinct teeth. Thorax more robust than in the worker, the pro- and epinotum with more convex sides and the pronotum more convex above, so that the mesonotum is more impressed in profile. From above the mesonotum is scarcely twice as broad as long. Petiole much larger than in the worker, with very short, slender peduncle, without ventral projection; node large, very convex in front, from above more than twice as broad as long, broader than the epinotum and nearly half as broad as the postpetiole. Gaster very much larger than in the worker, more than twice as long as broad, suboblong, flattened dorsoventrally.

Sculpture as in the worker, but the piligerous punctures, especially on the head, much coarser, almost foveolate and somewhat elongated on the sides of the front. Cheeks and sides of epinotum subopaque, finely rugulose-punctate.

Hairs coarser and longer, especially on the body, than in the worker.

Color more brownish ferruginous; mandibles, antennae, and legs more yellowish; pleurae, sides of petiole, and sutures of gaster brownish yellow.

Queensland: Herberton (type locality), Atherton and Cedar Creek (E. Mjöberg); Kuranda (Wheeler).

October 24, I found two fine colonies of this species in rotten logs. One comprised at least 400 workers, a single queen, with the abdomen greatly distended with eggs, and a large number of nearly mature larvae but no pupae. The other colony was somewhat less populous but also contained many larvae. The ants moved rather slowly in long files through the cracks in the wood, evidently endeavoring to keep in close touch with one another by means of their antennae, after the manner of the Dorylinae. They stung severely for such small insects.

The worker of *O. mjöbergi* is readily distinguished from that of *hedleyi* by its paler color, shorter head, antennal scapes and funicular joints, the straight dorsal profile of the thorax, broader epinotum and petiole, deeper constriction between the postpetiole and gaster, and smooth, shining, and sparsely punctate mandibles.

ONYCHOMYRMEX DODDI, sp. nov.

Plate **2**, fig. 3–5.

Worker. Length: 2–2.5 mm.

Head subrectangular, about $\frac{1}{5}$ longer than broad, scarcely broader in front than behind, with nearly straight lateral and posterior borders and rounded posterior corners. Clypeus with broadly arcuate, finely denticulate anterior border, sinuate on the sides. Eyes very similar to those of the preceding species, situated about $\frac{3}{5}$ the distance from the anterior to the posterior border of the head. Mandibles with the long terminal tooth less abruptly bent inward, remaining teeth rather small. Antennal scapes $\frac{3}{4}$ as long as the head; first and terminal funicular joints fully twice as long as broad, remaining joints scarcely longer than broad. Thorax rather stout, shaped much as in *mjöbergi*, with straight, horizontal dorsal outline, the pronotum longer than broad, rising rather abruptly from the neck, but posteriorly flattened above, its sides only feebly convex. Mesonotum somewhat more than twice as broad as long. Thoracic sutures very distinct. Epinotum in profile with the base feebly and evenly convex and longer than the declivity which is sloping and distinctly concave. Petiole in profile with a short basal peduncle and prominent, compressed, somewhat translucent ventral projection; the node with subequal anterior and dorsal surfaces, both feebly convex; seen from above as long as broad, subrectangular, with rounded sides and straight, subequal anterior and posterior borders. Postpetiole as long as broad, very convex below and separated by a pronounced constriction from the gaster. Legs as in *mjöbergi*.

Smooth and shining, covered with small piligerous punctures, which are most abundant on the head and especially on the cheeks. Mandibles, clypeus, and cheeks opaque, the mandibles finely and sharply striate and sparsely punctate, the clypeus densely transversely rugulose.

Pilosity pale yellow, much as in *hedleyi* but shorter.

Color also like that of *hedleyi*, deep castaneous, nearly black; mandibles, except the teeth, clypeus, and frontal carinae deep brownish red; antennae, legs, and tip of gaster yellowish brown; coxae and middle portions of femora and tibiae darker.

Female. Length nearly 4 mm.

Resembling the female of *mjöbergi* in form, but the head is proportionally broader behind and without lateral impressions; differing from the worker in the shape of the head, which is broadened in front, the feebly dentate, less curved mandibles and the stouter thorax and larger petiole, postpetiole, and gaster. The sides and dorsal surface of the pro- and epinotum are more convex than in the worker and the promesonotal and mesoëpinotal sutures are more impressed so that the dorsal outline is much less straight and continuous. Mesonotum not more than twice as broad as long. Petiole like that of the female *mjöbergi*, the peduncle very small, the node very large, convex and rounded in front and on the sides, with straight posterior border; seen from above it is only a little more than 1½ times as broad as long, scarcely broader than the epinotum and more than half as broad as the postpetiole. The latter is separated by a very slight constriction from the gaster, which is large and shaped much as in the female *mjöbergi*.

Sculpture and color as in the worker, hairs considerably longer and coarser, especially on the postpetiole and gaster.

Queensland: Kuranda (Wheeler).

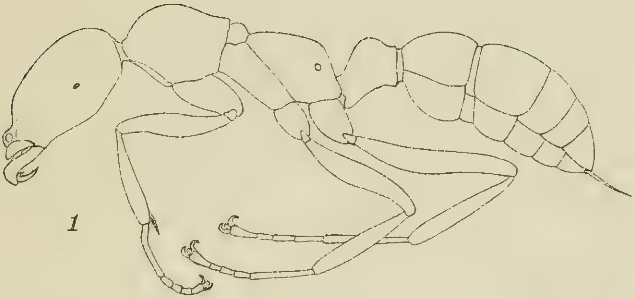
I found only one colony of this ant (November 1), consisting of a female and nearly 50 workers, but without larvae, in a small log in a damp, shady spot in the dense "scrub."

The worker is readily distinguished from both *hedleyi* and *mjöbergi* by its smaller size and less abruptly curved mandibles; from *mjöbergi* by its color, longer head, striated mandibles and finer pilosity; from *hedleyi* by the straight dorsal outline of the thorax and less convex pronotum, shorter petiole, scapes, and funicular joints.

PLATE 1.

PLATE 1.

1. *Onychomyrmex hedleyi* Emery. Worker, lateral view.
2. Head of same; dorsal view.
3. *O. mjöbergi* Forel. Worker, lateral view.
4. Head of same, dorsal view.
5. *O. mjöbergi* Forel. Female, lateral view.
6. Head of same, dorsal view.
7. Adult larva of *O. mjöbergi*, lateral view.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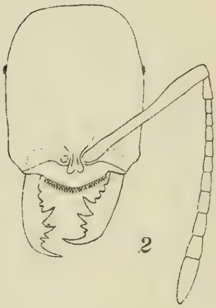
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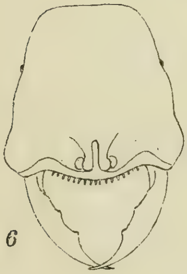
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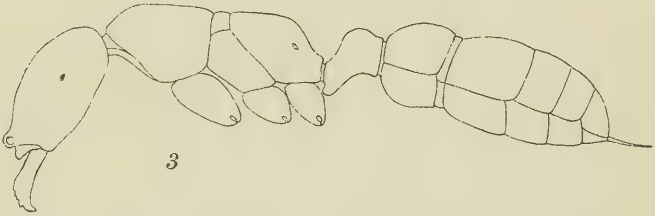
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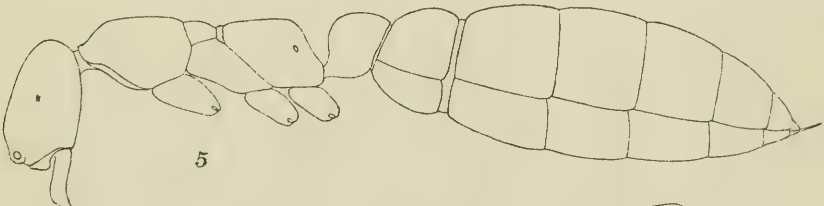
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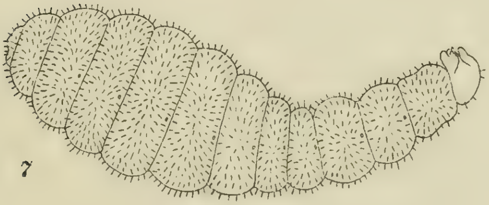
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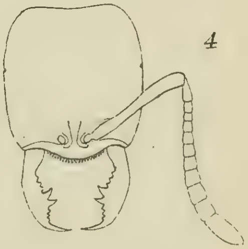
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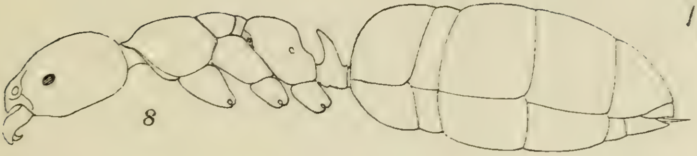
PLATE 2.

PLATE 2.

1. *O. mjöbergi* Forel. Head of larva, lateral view.
1a. Mandible of same.
2. Head of same, dorsal view.
3. *O. doddi* Wheeler. Worker, dorsal view.
4. Thorax and abdomen of same, lateral view.
5. *O. doddi* Wheeler. Female, dorsal view.
6. *Leptogenys* (*Lobopelta*) *fallax* Mayr subsp. *fortis* Forel. Worker, lateral view.
7. Head of same, dorsal view.
8. *L.* (*L.*) *fallax* Mayr subsp. *fortis* Forel. Female, lateral view.
9. Head of same, dorsal view.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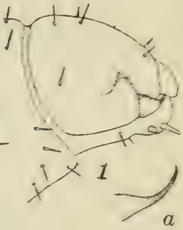
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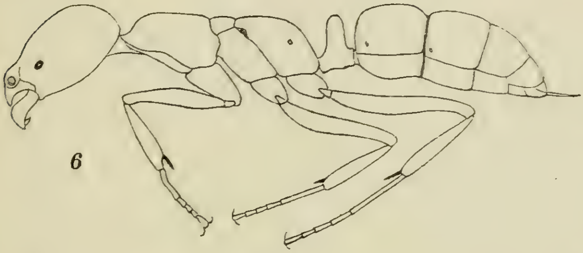
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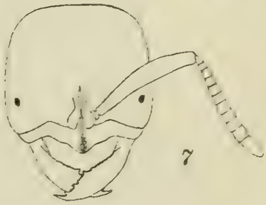
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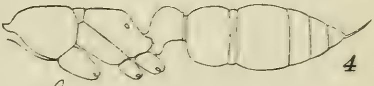
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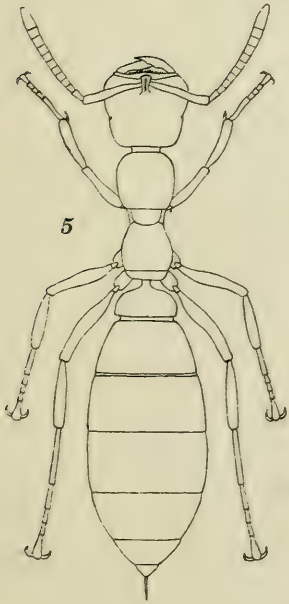
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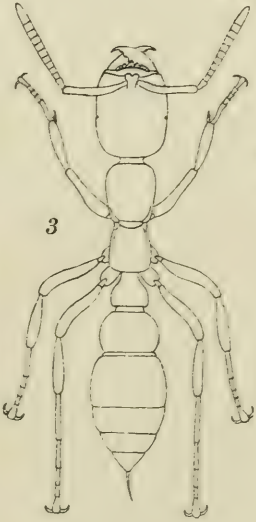
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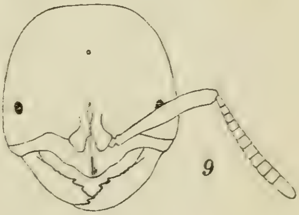
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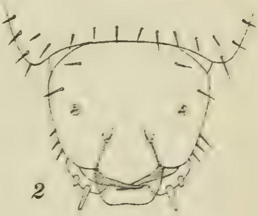
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THE SPERMATOGENESIS OF PHRYNOTETTIX MAGNUS, WITH SPECIAL REFERENCE TO SYNAPSIS AND THE INDIVIDUALITY OF THE CHROMOSOMES.

By D. H. Wenrich.

With Ten Plates.

CAMBRIDGE, MASS., U. S. A.:
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No. 3.— *The Spermatogenesis of Phrynotettix magnus, with special Reference to Synapsis and the Individuality of the Chromosomes.*

By D. H. Wenrich.

CONTRIBUTIONS FROM THE ZOÖLOGICAL LABORATORY OF THE MUSEUM OF COMPARATIVE ZOÖLOGY AT HARVARD COLLEGE. No. 266.

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I. INTRODUCTION.

A. Outline of the Problems.

Two of the most important subjects which have claimed the attention of cytologists for many years are the two named in the subtitle of this paper. Every species of animals and plants is thought to have a definite number of chromosomes, which is characteristic for the species. In the process of maturation this typical, or diploid, number becomes reduced so that each functional gamete contains only half that number, the haploid number. It is generally believed that the process of reduction is initiated by a pairing of the chromosomes in the prophase of the first maturation division. It is also generally admitted that of the two chromosomes which united to form a single pair, one has been derived from the maternal, and the other from the paternal ancestor, and that these become separated again at one of the two maturation divisions. But there has been a considerable amount of disagreement as to how the pairing of the chromosomes takes place, and also differences of opinion as to which of the two maturation divisions results in their separation.

As to the process by which the pairing of chromosomes is accomplished, the two opposing views that have been most widely discussed are: — (1) that homologous chromosomes unite side-by-side (parasynapsis), or (2) that they unite end-to-end (telosynapsis). The adoption of either view, however, involves the very important assumption that there is a continuity between the chromosomes that appear in the earlier divisions and those that conjugate. Doubt has been expressed by some writers as to the existence of any such continuity, or individuality, of the chromosomes, and the question is regarded as one that is still unsettled. Many geneticists, on the other hand, are readily inclined to correlate the behavior of the chromosomes in maturation with the behavior of Mendelian factors in heredity. And in some cases an organization of the individual chromosomes has been assumed of such a nature that a definite portion or region of a chromosome is concerned with the transmission of a particular factor. Such assumptions call for an analysis of the individual chromosomes to determine their inner constitution or architecture.

The author of the present study has sought to throw light on all these problems. That as to how synapsis takes place was the first considered; it was taken up from the standpoint of the origin and constitution of the chromosomes of the first spermatocytes. Early in the work it was found that the only method by which conclusive results could be obtained was that of following the history of individual chromosomes. Owing to the favorableness of the material, at least three chromosome-pairs were found that possessed individual peculiarities by which they could be recognized through all stages from the growth-period to their division in the first spermatocyte mitosis. Pursuit of this method naturally led to a consideration of the problem of the individuality of the chromosomes, and it was found to be possible to recognize one pair of chromosomes at all stages from spermatognia to spermatids. A further study of chromosome-individuality led to the interesting discovery that each chromosome has a definite organization, or architecture, which appears at the same stages in all the animals studied.

In the following description, I have not followed the usual method of adhering to the chronological sequence of events, but have adopted the order in which the problems presented themselves. I believe I have been able through a study of this material to demonstrate that in Phrynotettix (1) parasynapsis occurs, (2) usually the first maturation is equational, (3) each chromosome preserves its individuality throughout the spermatogenic cell-generations, and (4) at least certain chromosomes, and probably all, have a recognizably constant organization.

B. Material and Acknowledgments.

Phrynotettix magnus belongs to the subfamily Oedipodinae of the orthopteran family Acrididae. The specimens that furnished the basis for this investigation were collected in 1907 near the Santa Rita Mountains of southern Arizona, by a collecting party from the University of Kansas. The testes were dissected out and fixed in Flemming's stronger solution. Sections were cut 6–12 micra thick and stained either by Heidenhain's iron-haematoxylin, or by Flemming's tricolor, method. Material from thirteen animals was available and consisted partly of the slides used by Miss Pinney as the basis of her paper of 1908, partly of other slides prepared in Dr. McClung's laboratory, and lastly of material sectioned and stained by the writer.

The work was begun in 1911 at the University of Kansas under the direction of Prof. C. E. McClung, to whom I am indebted for the material used and for advice and kindly interest throughout. The greater part of the work was done at Harvard University during the years 1912–1915 under the direction of Prof. E. L. Mark, to whom I owe my warmest thanks for valuable criticism and suggestions and for sympathetic interest at all times. I am also indebted to Miss Eleanor Carothers, formerly a fellow student, for some collaboration, especially with reference to the so-called "plasmosomes."

II. OBSERVATIONS.

A. Outline of spermatogenesis: Nomenclature.

a. Introductory.

There is some confusion in the literature on maturation in regard to the use of the terms applied to the various steps and processes in the history of germ-cells undergoing development into gametes. This is due in part to differences in the details of the processes in the various forms investigated, and in part to different interpretations of similar stages by different authors. It therefore seems necessary, or at least expedient, to explain the terms that one wishes to use in description. A brief outline of acridian spermatogenesis follows, in connection with which the nomenclature employed will be explained. In addition, enough of the peculiarities of Phrynotettix will be described to render clear any new terms made necessary by them.

Wilcox ('94) and Davis ('08) have both given detailed descriptions of the structure of the acridian testis and have given figures or diagrams to show the topography of the follicles of which the testes are composed. It will therefore be unnecessary to reproduce such figures and descriptions here.

b. Outline of successive Stages.

1. *Spermatogonia.*— The spermatogonia of Phrynotettix (Plates 1, 2, fig. 1–20) behave in a manner typical for the Acrididae as described especially by Sutton ('00), and by Davis ('08). As Pinney ('08) has shown, there are 23 chromosomes, of which 22 can be arranged in pairs, leaving an odd one, the accessory chromosome (McClung, '99), or monosome (Montgomery, '06). The paired chromosomes may be referred to as the autosomes (Montgomery, '06). All the divisions of the spermatogonia are mitotic and are usually considered as equivalent to somatic mitoses. A detailed account of these divisions is given on pages 87–90.

2. *Primary spermatocytes.*— The daughter cells produced at the final spermatogonial division, as is well known, are characterized, among other things, by the growth-period and by the formation of the reduced, or haploid, number of chromosomes. For distinguishing the different stages in the prophases, Davis ('08) employed a non-descriptive method, designating successive stages by the successive letters of the alphabet. Here it seems advisable to use largely the terminology introduced by Winniwarter and by Grégoire.

The telophase of the last spermatogonial division embraces a series of processes similar to those in the telophases of the earlier spermatogonial divisions. Following the telophase, a series of changes takes place which results eventually in the formation of fine single threads. This fine-thread stage may be called the *leptotene* stage (Winniwarter, '00). Between the telophase and the leptotene stages occur changes which are of the utmost importance in any attempt to solve the problems of synapsis and the individuality of the chromosomes. These stages may be called the *preleptotene* stages (Grégoire, '07). There may be distinguished an earlier (Plate 2, fig. 23, 24) and a later (Plate 3, fig. 25–27) preleptotene stage.

When the leptotene threads are first formed, they seem to be greatly tangled and lack definite arrangement. This condition, which may be called early leptotene (fig. 28), is followed by a later leptotene (fig. 29), in which the threads become oriented with one end attached at one side (the polar side) of the nucleus. Soon there appear among the single threads others which are double and twice the width of the single ones. The proportionate number of double threads gradually increases until all the threads appear double. The stage during which the doubling takes place (fig. 30, 31) is the *zygotene* stage of Grégoire ('07). When all the threads have become double the *pachytene* stage (Winniwarter, '00) has been reached (Plate 3, fig. 32–34). This term continues to be applicable throughout the relatively long growth-period, and until the spireme[1] breaks up into the haploid number of segments, which become tetrads. The number of pachytene threads seems to be much less than that of the leptotene threads.

The stages characterized by the appearance of separate segments of the spireme may be designated by the term *diplotene* of Winniwarter ('00). This term is used for the sake of consistency with the others employed, although the conditions in Phrynotettix differ somewhat from those described by Winniwarter for mammals. He describes the longitudinal split as disappearing in the pachytene stages, on account of the threads becoming twisted, and reappearing in the diplotene stage. In Phrynotettix the longitudinal split remains visible and little or no twisting occurs.

Soon after becoming independent, a second longitudinal split occurs in the spireme segments at right angles to the first, thus forming typical tetrads, each composed of four *chromatids* (McClung, '00). The first longitudinal split, which persists from the pachytene stage, may be called the *primary split*, and the one at right angles to it may be called the *secondary split*. From the time of their formation until the succeeding metaphase, the tetrads undergo a gradual shortening and thickening. During this period they pass through the well-known figures, X's, K's, 8's, rings and crosses (Plate 3, fig. 38). The stage during which these changes occur is frequently referred to as the *diakinesis* stage (Häcker, '95^{a}), but it may be simpler to call it the *postspireme* stage (Grégoire, '07), or the tetrad stage.[2]

The postspireme stages end with the establishment of the tetrad-chromosomes upon the mitotic spindle of the first spermatocyte division. The number thus appearing on the spindle is twelve (Plate **4**, fig. 39). One of them is the accessory chromosome, which is a dyad and passes to one pole undivided (Plate **4**, fig. 41, *X*). The eleven tetrads represent the other twenty-two spermatogonial chromosomes arranged in pairs. One daughter cell of each spermatocyte receives eleven dyads and the other receives twelve, the additional one in the latter case being the accessory chromosome.

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[1] The term spireme will be used to embrace the stages included under the names leptotene, zygotene, and pachytene without, however, implying anything as to the existence of a continuous thread.

[2] I have avoided the use of the term, prophase, in connection with the postspireme stages because it might properly be applied to the whole series of stages from the preleptotene to the metaphase.

In the anaphase all the chromosomes appear as V's, thus showing their dyad constitution (fig. 42 and 43). Before this, in the metaphase, the separate chromatids are not discernible, but early in the anaphase they separate from each other at the end opposite that which is attached to the spindle-fiber, in this way giving rise to the V-shaped figures. The V-shaped arrangement persists until the metaphase of the succeeding division is reached.

3. *Secondary spermatocytes.*— The secondary spermatocytes present only a short resting stage. For this stage, between the formation of the secondary spermatocytes and their division, we may employ the term *interkinesis* (intercinèse) proposed by Grégoire (**'05**). The extent of diffusion reached by the dyads in interkinesis is much greater than that usually described for this stage, as will be seen from figures 46 and 47 (Plate **4**). The dyads reappear however, in the same orientation and relative positions that they had before diffusion.

In the metaphase the dyads show the same double structure that they did in the anaphase of the immediately preceding division (Plate **5**, fig. 50–52). The two monads composing each dyad are separated from each other in the metaphase, and in the anaphase are carried to the poles of the spindle (fig. 54). Half of the secondary spermatocytes show in the plates of the metaphase eleven chromosomes and the other half twelve chromosomes, as was to have been expected owing to the non-division of the monosome in the division of the primary spermatocytes. Figure 50 (Plate **5**) shows eleven and figure 51 shows twelve chromosomes.

The term *reductional* will be used to designate that one of the two maturation divisions which results in the separation of the chromosomes that conjugated in synapsis. Correspondingly the term *equational* will be applied to the division in which the halves of whole chromosomes are separated. Employing the terminology of Korschelt und Heider (**'03**), we may use the terms *prereduction* when the first maturation division is reductional, and *postreduction* when the second division is reductional.

4. *Spermatids.*— The spermatids, daughter cells of the secondary spermatocytes, undergo gradual transformation, without further division, into the mature spermatozoa. Their chromosomes undergo dissolution, having, however, first formed a network not unlike that found in the telophase of ordinary mitoses.

5. *Spermatozoa.*— This term is used, as usual, to designate the functional male gametes — the end products of all the preceding processes.

c. *Additional Features.*

In Phrynotettix, as pointed out by Pinney (**'08**), there appear in many of the stages of spermatogenesis condensed and deeply staining granules at the ends of the chromosomes. These granules are recognizable in the stages where the greater part of the chromatin is extended or diffuse, so that their density, contrasted with that of the rest of the chromatin, brings them into view. Figures 8, 10, 12 (Plate **1**) and 14–20 (Plate **2**) show them for the spermatogonia; figures 28–38 (Plate **3**) for the primary spermatocytes; figures 45–48 (Plate **4**) for the interkinesis stage, and figure 55 (Plate **5**), for the spermatids. These granules appear at that end of each chromosome — including the accessory — to which the spindle-fiber attaches. They were named accordingly by Miss Pinney *polar granules.* In the case of certain chromosomes, as noted by her, similar granules also occur at the end of the chromosome opposite that to which the spindle-fiber attaches. The chromosomes are thus seen to exhibit polarity and it will therefore be convenient to designate the two ends by different terms. In the absence of better terms, I shall call the end to which the spindle-fiber attaches the proximal or synaptic end, and the opposite one the distal end.

At various stages there is a tendency for some of the polar granules to fuse together, as noted by Pinney **'08**, forming what I shall call *composite granules.* These are to be seen in the telophase and prophase of the spermatogonia (Plate **1**, fig. 12; and Plate **2**, fig. 14, 16), in the spireme stages of the primary spermatocytes (Plate **3**, fig. 33–36), and even in the connective-tissue nuclei (Plate **9**, fig. 108–110). They are particularly noticeable in the pachytene stages, for during that period quite large masses of chromatin may form by the coalescence of a number of these polar granules. The number of granules making up a composite granule is variable, but may usually be determined by the number of spireme threads attached to it. These sometimes radiate out from the composite granule like the spokes of a wheel from its hub. Such a stage corresponds to the *bouquet* stage of Eisen ('00). At the end of the pachytene stage the granules composing the composites separate out again, apparently without having changed their identity (Plate **3**, fig. 35–37).

The tendency of the polar granules to remain on one side of the nucleus may be interpreted as evidence of a somewhat persistent polarity of the nucleus as a whole. It will therefore be convenient to speak of that region of the nucleus where the majority of the polar granules are congregated as the *proximal* pole, and the opposite side as the *distal* pole, of the nucleus.

In my description of the leptotene and zygotene stages it will have been noticed that no mention is made of the contraction, or *synezesis*, stage (McClung '05). Such a phenomenon has not appeared in my material and, as has been claimed by McClung ('00, '05), Davis ('08) and others, is probably not normal in the Orthoptera.

I shall use the term synapsis in the same sense in which it was originally used by Moore ('95), that is, to indicate the process of coupling or conjugation of the chromosomes of the last spermatogonia to form those of the first spermatocyte. Following Wilson ('09), I shall use *parasynapsis* to denote side-by-side conjugation, and *telosynapsis* to denote end-to-end conjugation.

For the purpose of determining more accurately the history of the changes undergone by the chromatin through the successive stages outlined above, three individual autosome-pairs have been selected for detailed study. To distinguish them from the other autosomes, I shall call them the *selected* chromosomes.

B. Synapsis.

a. The Postspireme Stages.

Of the various methods by which the diploid series of chromosomes could unite in pairs to form the haploid, or reduced, series, the two which have been more frequently defended are: — (1) that by which the members of each pair unite end-to-end (telosynapsis), and (2) that by which they unite side-by-side (parasynapsis). Evidence in favor of both methods has been gained from observations on orthopteran material. The writer, without prejudice in favor of either view, undertook to discover which of these processes occurs in Phrynotettix.

Efforts were first directed to a study of the postspireme stages in the hope of discovering how the segments of the pachytene spireme became the tetrads exhibiting the shapes of V's, X's, 8's, crosses and rings. Such a variety of shapes and forms presented themselves at any one of the tetrad stages, however, that it was impossible to decide which were the more primitive and which the derived forms. Figure 38, *a–g* (Plate **3**), for example, shows some of the different shapes of tetrads seen in a single stage and, indeed, in the same cyst. The only method that seemed to offer a means of securing decisive evidence on the problem was that of following the history of individual chromosome-pairs through a large number of stages. For this purpose it was necessary to find pairs which possessed individual characteristics by which they could be recognized in all the stages concerned. Fortunately, at least three pairs were found which fulfilled these requirements. For convenience in description they have been designated "*A*," "*B*," and "*C*."

1. *Chromosome-pair A.*— This element was first distinguished in the pachytene stage, where it is a very deeply stained spireme segment. Examples of it are shown in figures 56 and 57, (Plate **5**). Its differential staining property is so marked and constant that it can be recognized by this character alone up to the later postspireme stages. But there is an additional means of identification. Like most of the pachytene threads, this one normally makes a loop the two ends of which approach to, or attach at, the proximal pole of the nucleus (Plate **5**, fig. 56). One or both ends may become free from entanglements, but more frequently only one. In the latter case the free end, or if both ends are free, one of them, is nearly always terminated by two knobs, of which one is usually larger and less deeply stained than the other (Plate **5**, fig. 57*g*; Plate **10**, fig. 113). These knobs, I believe, may be identified as the polar granules described by Miss Pinney (**'08**). But in this instance, as shown by numerous observations, the more prominent granules occur at the distal end of the chromosome instead of the proximal end, where they are found on the majority of the other chromosomes. That the expanded condition of one of the granules furnishes a means of identification, will be apparent from an examination of figure 62 (Plate **6**).

As an exceptional occurrence these two terminal granules may be equal in size, neither one being expanded. In order to test the relative frequency of these two conditions, some counts were made and tabulated for both the spireme and postspireme stages, as follows: —

Stage	Total	Expanded	Not expanded	% Expanded
Spireme	111	94	7	93.06
Postspireme	162	146	16	90.12
Both stages	273	240	23	91.26

It will be seen from this table that approximately 90% (examples counted at random) have one of the granules in the expanded condition. In the postspireme stages this peculiarity appears less like an expanded single granule than as a group of closely associated small granules, typically three in number. This condition will be discussed more fully in another place (p. 112). In both the spireme and the postspireme stages the modified polar granule furnishes a ready means of identification of chromosome-pair *A*, especially when its staining qualities, already described, are taken into consideration. The constant relative size of *A* in the tetrad stages is also a help in identification.

Figure 62 (Plate 6) indicates clearly the processes by which the spireme loop becomes first transformed into a typical tetrad, and then condensed to a metaphase chromosome. From the zygotene stage onward, there is a gradual shortening of the spireme loops or segments. The later stages of this process are to be seen in figure 62. Throughout the pachytene stage the spireme loops exhibit a median longitudinal cleft, usually referred to as the longitudinal split. I shall call this the primary longitudinal split. Occasionally paired granules, or chromomeres, appear to be fused together, but as a general rule, the split is continuous throughout the length of the loop. In my opinion this so-called longitudinal split is really the space between two spireme (leptotene) threads which have conjugated side-by-side. Further evidence for this belief will be presented later.

Figure 62, *c*, indicates the first step in the process of forming the four chromatids of the tetrad. A second longitudinal split, at right angles to the first or primary split, begins at the proximal end (upper end in the figures) of the free spireme segment (fig. 62, *c*) and gradually proceeds toward the distal (lower) end (fig. 62, *c–e*). It will be seen from these figures that as the separation produced by the secondary split proceeds distally, the separated chromatids at the same time reunite along the plane of the primary split. The separation due to the secondary split gradually increases until the diverging pairs of chromatids extend in opposite directions, thus forming a rod-like element the two ends of which correspond to the proximal pole of the original spireme segment, and its middle point to the distal pole. The rod-shaped tetrad becomes oriented in the spindle of the first maturation division with its long axis parallel to the spindle-axis, and at metaphase separates in the middle. In other words, the plane of the secondary split becomes the plane of the first maturation division, which is therefore equational. If now we may assume that the longitudinally split spireme segment has represented a pair of chromatin-threads which had conjugated side-by-side throughout their length, the plane of the primary split must be the plane of the reductional division, which becomes effective in the second spermatocyte mitosis.

The tetrad *A* also forms rings, as shown in figure 62, *j*, *k*, *l* (Plate **6**). I have not been able to trace these rings into the metaphase to determine their orientation on the spindle, and furthermore I am quite uncertain whether the ring shape persists as far as the metaphase. Most of the metaphase figures show one tetrad in the form of a rod with its axis parallel to the spindle-axis, and with a constriction in the middle, as shown in figure 62, *i* and figure 79, *A* (Plate **7**). Sometimes two or more rod-shaped tetrads are to be seen in the same spindle and with the same orientation. However, one of them is always in a more advanced stage of division than the others, and I have been inclined to identify this precocious one with tetrad *A*. Figure 62, *c–i*, indicates that such a conclusion is justified. Since the straight-rod condition is so characteristic of the metaphase, it may be that the rings also become transformed into straight rods by the time the metaphase is reached.

The rings seem to have been formed either by a failure of the proximal ends to separate during the formation of the secondary longitudinal split, or by a secondary union of these ends, *i. e.* after the split had begun. For example, if a tetrad in the condition of figure 62, *c*, has the secondary split completed without the separation of the proximal ends, a ring would result. So also would a ring be formed by a secondary union of the two proximal ends of a stage such as is seen in figure 62, *d* or *e*. In either event the region within the ring would represent the space formed as a result of the secondary longitudinal split. If the chromatids should now begin to separate at the proximal end along the plane of the primary split, as seems to be indicated in figure 62, *k* and *l*, and if this process should be continued until a metaphase chromosome such as that shown in *i* is produced, there is every reason to believe that it would result in a separation of the original conjugants of the pair, and therefore constitute a reductional division. On the other hand, it is possible that the separation along the plane of the primary split is never completed, but that the chromatids again become separated at the proximal end, assuming the forms shown at *f* to *i*, figure 62, and that the first division is therefore always equational. However, the possibility of an occasional reductional division as a result of the ring-formation must be taken into consideration.

2. *Chromosome-pair B.* Figure 63 (Plate 6) presents a series of stages for *B* corresponding to those in figure 62 for *A*. This series of stages of *B* supports the conclusions reached from a study of *A* in regard to: — (1) a probable parallel association in the pachytene stages of pairs of threads, each representing individual chromosomes; (2) the formation of the tetrad by, first, a separation along the plane of conjugation (*i. e.*, the primary longitudinal split) and, secondly, by a splitting of each of the original conjugants (the secondary longitudinal split); and (3), as a result, an equational division of the tetrads at the first division.

This chromosome-pair (*B*) is characterized by the presence of large and well-marked polar granules at both ends and by a similar large granule not far from the middle, though always somewhat nearer the distal end. Leaving aside the formation of rings, the chief difference in behavior between *A* and *B* is that in the former the plane along which the greatest separation takes place before metaphase is that of the secondary longitudinal split, while in the latter the greatest separation takes place along the plane of the primary split. This results in *A* becoming extended in the direction of the spindle-axis, as already described, while *B* becomes extended at right angles to this axis. In the latter case the separation along the plane of the primary split does not become complete at the expense of the separation along the plane of the secondary split, but the latter separation persists for a short distance, giving rise to a cross with unequal arms (fig. 63, *g*, *h*). The short arms terminate in the proximal or synaptic ends of the chromatids, while the longer arms terminate in the distal ends.

However, these differences in behavior between *A* and *B* are not fundamental, since the final result, an equational division, is the same in both cases. But they are indications of the individual peculiarities of these elements. It should also be pointed out that such differences could easily be misinterpreted, if only parts of the histories of the pairs were known.

It is important to note that the drawings of the series shown in figure 63 were all taken from sections of a single testis. In searching for the same element in other individuals, I was surprised to find the condition shown in figure 64, *a–h*. In this series are found the same differentiating characters that have already been described for *B*, except that one member of the large pair of granules at the distal end is lacking. In other words, we have to do here with a pair, composed of unequal elements, which differs from its homologue in another individual, composed of equal elements, by the absence of a definite part of one of the components. Examination of all the thirteen individuals demonstrated that eleven of them possessed this second or unequal type, while only two showed the equal type.

If there could have been any doubt about the sequence of events in the transformation of a spireme segment into a tetrad and the subsequent equational division in the case of chromosome-pair *A* or the equal type of *B*, the behavior of this unequal type of *B*, as shown in figure 64, must certainly make the subject clear. In this instance, on account of the difference between the two members, it is possible to identify them in such a way that there can be no question as to the two planes of longitudinal splitting. The figures have in all cases been made with great care with the aid of a camera lucida and are faithful reproductions of the conditions seen under the microscope so far as they can be represented by the method of reproduction used.

In the early stages of the transformation of the spireme segments into tetrads, the separate chromatids are not distinguishable throughout the whole length of the segment. This is due in part to a closer association of the chromatids and in part to the fact that one of the longitudinal splits becomes more pronounced at one end and the other split at the other end of the tetrad. Somewhere between the ends, therefore, there is a crossing or apparent chiasma. At the point of the crossing the chromatids at first appear to be fused together (figs. 63, *d* and 64, *d*). Very soon, however, the confusion disappears, the chromatids become distinct, and their relationships easily discernible, as shown in figures 63, *e*, and 64, *e*. In both these cases the wide separation at the proximal end has been along the plane of the secondary longitudinal split, and that at the distal end along the plane of the primary split. The resulting crossing, or apparent chiasma, is a perfectly normal and natural result of these processes and indicates nothing in the way of a breaking or recombining of the parts of chromatids.

3. *Chromosome-pair C.*— Figure 65 (Plate 6) shows one form of the third of the three selected chromosome-pairs. In this case the two components are very unequal in size, one of them possessing a very large, condensed mass, or granule, of chromatin at its distal end,

while the other has none. It will be noticed (fig. 65, *b, c*) that the details of the two components are quite homologous up to the large distal granule, and that the point of attachment of this large granule seems to correspond to the distal end of the smaller component. These considerations would lead us to suppose that here, too, as in the unequal type of *B*, the difference between the members of the pair may be due to the loss by one of them of a definite part possessed by the other. In this case, however, no such equal pair has been found as occurs in *B* when both members possess the part in question. The side-by-side association of the members of this pair is as evident as it was for *A* and *B* and the relations of the two longitudinal splits are the same.

In regard to the mode of distribution of tetrad parts in the first maturation division, however, we meet in this case a curious exception to the general rule. This pair divides equationally, as shown in figure 65, *h–j;* but it sometimes divides reductionally as shown at *k–m*, same figure. From casual inspection it appeared that the division occurred as frequently in the one manner as in the other. But in order to test the relative frequencies of the two methods, 928 cases chosen at random were counted and it was found that of this number 472, or 50.8%, were in process of reductional division, while 456, or 49.2%, were dividing equationally. It would seem from these counts that the method by which the tetrad divides is a matter of mere chance. This is the more apparent when we take into consideration the fact, brought out by extended observations, that the two methods occurred side-by-side in the same cysts. It may be that the shape or position of the tetrad when it is first brought under the influence of the mitotic spindle determines the mode of division.

The fact that this unequal pair divided in the first division reductionally a part of the time made it possible to study the distribution of the two conjugants with reference to the accessory chromosome, which goes to one pole undivided. It was soon found that either member of the pair could accompany the accessory into the secondary spermatocytes. Consequently counts were made to determine whether the two kinds of distribution occurred with anything like equal frequency. Out of 421 cases counted at random 216, or 51.3%, were found to show the larger member going to the same pole as the accessory (Plate **10**, fig. 121, *C*), while in 205, or 48.7%, of the cases the smaller member was going with the accessory to the same pole (fig. 120, *C*). These results seem to furnish a good example of chance distribution of chromosomes at maturation.

The behavior of these three selected chromosome-pairs, as described above in detail, seems to me to establish very definitely that the association of paired chromosomes in the pachytene stages is one in which the members lie side-by-side throughout their entire length, and therefore exhibit *parasynapsis.* I should further add that while I have not singled out any other members of the complex for individual study, a careful analysis of the other spireme segments and the derivative tetrads indicates that the condition of parasynapsis is realized for the entire series. I was thus able to analyze the stages of the complex as a whole after following the history of the selected individual pairs, whereas previously I was unable to reach a definite conclusion.

As to the method of division in the first spermatocytes, the evidence presented indicates that *B*, always, and *A*, in most cases, divide equationally, while *C* divides either reductionally or equationally and with equal frequency by each method. My study of the other tetrads leads me to think that, as a general rule, they divide equationally in the first division. Where the first division is equational the second is regarded as reductional, and we therefore have postreduction. The general rule has its exceptions, however, as already noted in the case of *C* and possibly sometimes in the case of *A*.

b. The Conjugation of Chromosomes.

1. *The formation of leptotene threads.*— The evidence for parasynapsis derived from a study of the postspireme stages, as presented in the preceding paragraphs, has not embraced the actual process of conjugation; and it therefore remains to be demonstrated that a side-by-side conjugation does take place. But it is even more important to show that the conjugants are actually chromosomes, the morphological descendants of the telophase chromosomes of the final spermatogonial division. Figure 21 (Plate 2) shows a side view and figure 22 a transverse (optical) section through the chromosomes of cells nearing the end of the telophase of the last spermatogonial division. The side view shows the chromosomes already partly diffused, but each one occupies a definite territory, so that there is no question as to their persistent individuality, except for the coalescence of some of the polar granules. But, as I shall point out later, the polar granules do not necessarily lose their identity when they unite into the compound masses. The optical section, figure 22, shows even more plainly the persistent individuality of the chromosomes up to this

point, for there still can be seen the remnants of the vesicular walls which surrounded each chromosome in the earlier telophase.

There are 21 of these chromatin-masses, or "blocs" (Janssens, '01), shown in this optical section, and that is sufficiently close to the total number, 23, to indicate that all the chromosomes are still independent, except for the union at the polar ends, as already mentioned.

In figure 21 it will be noticed that the diffusing chromatin is disposed roughly in the form of spirals. Figures 23 to 29 indicate what becomes of these spirals in the "blocs" of chromatin. I am not quite sure of the exact succession of stages here, but believe they are about as shown in the successive figures. It is possible that figures 23 and 24 — which are side view and optical section, respectively, of the same stage — are no earlier than the stages shown in figure 25 (Plate 3). However that may be, the evidence seems to indicate that each of the blocs at stages such as those shown in figures 21 and 22 gives rise to a single fine thread, at first much coiled but later much elongated.

The side view shown in figure 23 is at a stage the casual examination of which might lead one to suppose that the chromatin was in a hopeless tangle without any definite arrangement whatever. But careful focussing and patient study revealed what I have tried to show in figure 23, viz., that the chromatin is still disposed, for the most part, in separate blocs, but that a very much coiled and convoluted thread is forming within each one of these territories. Some have unraveled to a considerable extent, and have become extended in various directions through the nuclear sap. But each seems to be a continuous thread, despite some tendency for the ragged edges at times to be connected with adjacent threads. In the optical section of this stage (fig. 24) it will be seen that the blocs have remained in place and separate from each other for the most part, though some anastomosis of the linin fibers has taken place at the periphery of the blocs. On the other hand, there are still some remnants of the previously existing vesicular walls, as shown in the left side of the figure. When one focusses up and down on such a cell, it is possible to follow in some cases the thread which is differentiating out of the net-like structure of each bloc, but in optical section the reticulum is more apparent than the continuous thread. The section shows nineteen blocs, which number is not far from the somatic number of chromosomes (23). Figures 23 and 24 represent what I have called the preleptotene stage.

At the stage shown in figure 25 (Plate 3), which I believe to be slightly more advanced than the one in figures 23 and 24, the amount of anastomosis between adjacent chromatic elements seems considerably greater than in the stage last described. The anastomosis is to be seen more particularly at the sides of figure 25. Through the middle of this figure the individual spiral threads seem to be more easily distinguishable, and I am inclined to believe that the two which stain more deeply than the others are the members of the *A* pair of chromosomes. The stages including and following this reticular stage are hard to represent in a drawing of the kind employed, owing to the difficulty of portraying in their natural relations the parts seen at different planes of focus. Careful study has always convinced me, however, that the uncoiling and elongating threads are single, continuous, and not united into an indiscriminate network. I have selected in figures 26 and 27 views favorable for drawing where some of the threads, at least, are definitely separate and continuous across the diameter of the nucleus.

At the stage represented in figure 28 (Plate **3**) the unwinding of the coiled threads has been completed, but the threads have as yet no definite orientation. At the somewhat later leptotene stage shown in figure 29 the threads are finer and less homogenous than in the earlier stage, the substance of the thread seeming to have become more distinctly differentiated into a linin fiber and chromatic granules, the latter scattered at irregular intervals along the fiber. Moreover, in this later stage the threads appear to be definitely oriented, with one end attached at the proximal pole of the nucleus. The threads then take a course through the center of the nucleus or near its periphery, extending wholly or partly across and then turning back with a wide curve.

2. *The zygotene stages.*— In figure 30 (Plate **3**) some of the threads are double, others are single, and it would be difficult to decide from a casual examination of this stage alone whether or not the double threads had arisen by a splitting of the single ones. In the case of one or two of the double threads, however, as may be seen at the left side of the nucleus, the double condition does not continue throughout the whole length, but towards the distal end of the nucleus the thread is seen to branch into two single threads. I interpret this branching thread as one in which the parallel conjugation has not yet been completed. Another instance of the same kind may be seen in figure 31, which represents a stage somewhat more advanced than that of figure 30. These appearances lead me to believe that conjugation begins at the side of the nucleus corresponding to the proximal ends of the leptotene threads, and proceeds gradually toward their distal ends. It is further evident from these figures that conjugation is

not a simultaneous process for all the chromosome-pairs, but that it is a gradual process, some conjugating earlier than others. Just how the members of the different pairs are enabled to select their mates is a very puzzling question, but probably the stretching and orientation of the threads as shown in figure 29 might facilitate this process. That some of the pairs conjugate quite early, is shown in figure 30, where it may be seen that in selected pair *B* conjugation is complete. In figure 27, which is of a very much earlier stage, there are to be seen two of the still hazily defined threads lying side-by-side. They are similar enough in their constitution to be regarded as the two members of a pair, and it would not be surprising if conjugation should begin at a stage as early as this.

As an additional detail it should be pointed out that the bead-like granules which are strung along the threads of the leptotene and zygotene stages are not always of exactly equal size in the two conjugating elements. In figure 58 (Plate **5**) the example of chromosome-pair *B* well illustrates the disparity in size between the two members of some of the pairs of granules. This condition may well answer the criticisms of those who hold that the accuracy with which the granules are paired could be accounted for only on the assumption that they arose by a splitting of single granules into equal parts. I am able to show in this case that the members of each pair of granules are not always of equal size.

3. *The pachytene stages.*— Figures 32 and 33 (Plate **3**) are of early pachytene stages. It sometimes happens that even at such stages there may remain one or two pairs of threads that are not fully conjugated, though I have not added a drawing of such a condition. In the case of some of the pachytene threads of figure 32, complete loops have been formed, both ends being attached at the polar region. The formation of such loops is not necessarily the rule, however, as has been indicated already in connection with the spireme loops of the selected chromosome-pairs (fig. 56–61, Plate **5**). In figure 33 a scattered arrangement of the polar granules is to be seen, though they have coalesced to form several composite granules. Figure 34, of a later pachytene, exhibits one of the large composite granules. Figures 35–37 indicate how the composite granules break up into their component polar granules. A comparison of the examples of chromosome-pair *B* in figures 30 and 35 will indicate the extent of the process of gradual shortening which takes place during the pachytene stages. It will be noticed that the line of separation between the threads which have conjugated (*i. e.*, the primary longitudinal split) remains visible throughout the pachytene stages.

C. The Individuality of the Chromosomes.

a. The selected Chromosome Pairs.

The method adopted in the study of the subject of synapsis — that of following the history of individual chromosome-pairs — has naturally led to a consideration of the subject of the individuality of the chromosomes, that is, their persistence as morphological entities through all the stages of nuclear activity. I have already attempted to demonstrate that each of the chromosomes of the last spermatogonial division gives rise to a single leptotene thread and that these single threads conjugate two-by-two in the zygotene stage. It will be more convincing, however, if we can follow some particular chromosome-pair through these difficult stages.

1. *Chromosome-pair A.*— As the chief characteristic by which the chromosome-pair *A* could be recognized in the pachytene and later stages of the first spermatocytes, I have already described its great density and staining capacity. If there is a persistence of individual chromosomes from the spermatogonia to the spermatocytes, we should expect to find in the former a pair of chromosomes exhibiting the same peculiarities that the pair did in the later generation. Such a pair can, indeed, be found in the telophases not only of the last spermatogonial division but of the earlier spermatogonia as well. Figures 66 and 67 (Plate **6**) show such pairs of chromosomes more deeply stained than their fellows. Figure 66 shows one of the earlier generations of spermatogonia, as is indicated by the vesicular condition of the accessory chromosome, and figure 67 represents a telophase of the last spermatogonial division, as is shown by the condensed accessory at this stage.

It is difficult to follow all the changes that these chromosomes undergo in their transformation into pachytene threads, but I believe that most of the stages are represented in the series of drawings, figures 67–78. Figure 67 corresponds to a stage midway between those shown in figures 21 and 23 (Plate **2**). Figure 68 is of a stage corresponding very closely to that in figure 25 (Plate **3**). In figures 68 and 25, two bands or "blocs" of chromatin can be seen which are more deeply stained than the other chromatin-blocs. The accessory chromosome is distinguishable by its characteristic density and its position at the periphery of the nucleus. The polar granules are also distinguishable. The chromatin in these darker blocs (*A* in both figures 67 and 68) shows a more or less well-defined spiral condition. This spiral is better shown in figure 69, where it is more unravelled. Very soon after the process of uncoiling gives rise to the leptotene threads, stages in conjugation may be seen. Figure 70 shows an early leptotene stage with two threads which stain more deeply than the others, having conjugated as far as they can be traced in this particular section. I think we may identify these denser threads as the members of the chromosome-pair *A*.

The two sides of figure 70 are drawn differently. The left side is diagrammatic and is intended to represent the apparent entanglement of the leptotene threads. On the right side an attempt has been made to follow individual threads. Careful study makes it evident that the threads, instead of anastomosing, as they appear to do when one makes only a superficial examination of them, are really continuous and distinct for certain distances. The difficulty in following individual threads is due to the fact that after the early leptotene stage the chromatin collects into chromomeres, which are strung along a linin fiber, so fine and stainless in some places that it is scarcely traceable. When two such fibers cross each other in close proximity it is sometimes almost impossible to trace the independent courses of the two in the region of the apparent intersection.

There is less difficulty, however, in tracing the threads of *A*. At the stage shown in figure 71 — which corresponds with that in figure 29 (Plate **3**) the threads are very fine and well oriented. In this nucleus there can be seen a loop of heavier threads (*A*), which have the appearance of being two, loosely wrapped around each other. The accessory, as shown at *X*, also forms a heavy spireme loop at this stage, but it is so much heavier than the one described that there can be no confusion between the two. The deeply staining loop of interlaced threads I interpret to be the spireme of the chromosome-pair *A*. In figure 73 is shown an *A*-spireme which has not completed its conjugation. It will be noticed that of the other threads in this nucleus some are double and some are single; and, furthermore, that the double ones are twice the width of the single ones. In figure 74 the spiremes of the pair *A* have completely conjugated, though the general appearance of the cell indicates that the stage is no further advanced than that shown in figure 73. Figures 75–78 (Plate **7**) show the pair *A* in various stages of conjugation at stages closely corresponding to those shown in figures 73 and 74.

I have already traced the pair *A* from the pachytene stage to the metaphase of the first spermatocyte division, so that it now remains to examine only the stages following that division. Figure 80 (Plate **7**) shows a telophase of the first spermatocyte division as seen when looking from the equator toward the centrosome. There are eleven dyads here, and since the whole number could easily be counted, the accessory is not present. One of these dyads is more deeply stained than the others, and, judging from its size relations, I think we may identify this dyad as one from chromosome-pair *A*. This conclusion receives still stronger support from figures 81 *et seq.* Figure 81 is of a stage slightly later than the one in figure 80, and here we can see the dyad *A* in addition to the accessory dyad, which is less deeply stained than the others and is surrounded by a well-defined clear space, as indicated by the dotted line. In figure 82 is drawn a telophase in which the dyad *A* is shown in both the daughter cells. From these figures (80–82) it is apparent that this element cannot be confused with the accessory at these stages. In figures 83 and 84, however, it is less easy to distinguish between them. But a long and careful study has convinced me that the accessory, having early passed through a stage of greatest diffusion, soon becomes condensed, while the other dyads are undergoing dissolution. Dyad *A*, on the other hand, at first remains more condensed than the others and then gradually becomes diffused like them. Figure 83 shows an early interkinesis stage in which the large accessory dyad (*X*) is more condensed than that shown in figure 81, but where dyad *A* is still more dense. In figure 84, which is of a stage not much further advanced, the accessory is seen to be the most condensed dyad (*X*), whereas *A* has gone far toward its stage of diffusion corresponding to that of the other chromosomes. That the accessory remains condensed throughout interkinesis is further shown in figures 46 and 48 (Plate **4**). Figure 48 further shows that in the prophase of the second spermatocyte the *A* dyad condenses earlier than any other dyads except that of the accessory.

It was impossible to trace the *A* dyad into the metaphase of the secondary spermatocyte, but in the telophase it may again be recognized by its characteristic deeper staining and by its size relations. In figure 55 (Plate **5**), which is a polar view of such a telophase, three deeply staining chromatic masses are shown. The larger one (*X*) is probably the accessory, the next in size, the monad of *A*, and the smallest, a monad of *B* (p. 79). Figure 85 (Plate **7**) shows a somewhat later telophase, in which diffusion has progressed a little beyond that seen in figure 55. About the same relative staining qualities and relative sizes are seen as in figure 55. The accessory appears in only half of the secondary spermatocytes and spermatids, however, and figure 86 is of a pair of spermatids in which the accessory does not occur. The diffusion process has here proceeded beyond that shown in figure 85, but the two more deeply staining masses, representing the monads of *A* and *B*, can readily be distinguished.

We may on the strength of this evidence say that the chromosome-pair *A* can be traced from the spermatogonia to the spermatids, thus demonstrating a case of morphological identity through all these generations and stages.

2. *Chromosome-pair B*.— If morphological continuity is the general rule, and if the peculiarities of the chromosome-pairs *B* and *C* are distinctive enough, we should be able to trace the latter as we have traced *A*. In many stages, however, these smaller pairs are not so easily recognizable as was the pair *A*, but it has been possible to obtain good evidence for individuality even through them.

I have called attention to a dyad in interkinesis, and a monad in the spermatids, which seem to satisfy requirements for identification as the element *B*. In figures 80 and 83 (Plate **7**), for example, is seen a dyad smaller than *A*, which stains almost as deeply as the latter. An element with similar properties is to be seen in figures 55 (Plate **5**), 85 and 86 (Plate **7**). This element (*B* in the figures) has such size relations when compared with *A* and the smallest element (as seen in figure 80) as we should expect in *B;* when we consider, further, that in the postspireme stages *B* stained more deeply than the majority of the other tetrads, the staining qualities exhibited in these later stages should also furnish a means of identification.

When we look at the spermatogonial telophases of the same individual from which figure 63 was taken, that is, one in which the components of pair *B* are equal, we can readily find a pair of chromosomes that possesses the chief characteristic by which *B* was recognized in the postspireme stages, namely, the presence of a prominent polar granule at each end and a third not far from the middle, though nearer the distal end. Examples of such spermatogonial telophases are shown in figures 87–96 (Plate **8**). A further consideration of these stages is given on page 83.

The study of chromosome-pair *B* in the growth-period has furnished some of the most interesting data on the subject of chromosome individuality that I have secured. An analysis of this pair in its extended condition in the pachytene stages of the first spermatocyte was made for one of the specimens (no. 772) and then comparisons drawn between the conditions in this and those in all the other animals in the series studied.

Figure 58 (Plate 5) shows the element during the zygotene stages — as indicated by the incompletely conjugated pair of threads near the middle of the figure — in a condition of complete parallel association for the two conjugants, but a condition in which the members of the pairs of granules, the chromomeres, are distinct. A close examination of this spireme of *B* discloses a series of chromomeres in addition to, and smaller than, the three already mentioned as characterizing the element.

For convenience in description the more prominent granules or chromomeres will be given separate designations. The five granules which I wish to mention more particularly will be numbered in order from the proximal (no. 1) to the distal end (no. 5, figure 58). I shall also call attention to the two pairs of small granules between numbers 3 and 4 and to the two pairs of still smaller ones between 2 and 3. I should not omit to direct attention to the series of granules between numbers 1 and 2 and between numbers 4 and 5, but detailed consideration of those already mentioned will probably suffice for the purpose in view.

I was at first impressed by the constancy in relative size and position with which some of these granules recurred in different examples of *B* and at different stages in a single individual (no. 772). It then occurred to me to compare the same element at about the same stage for all the thirteen animals from which material was available. Figure 97 (Plate 8) is the result, each of the separate drawings having been taken from a different animal. The constancy with which the minute details of size and arrangement of the parts of this pair were repeated in all of the individuals was surprising. Not only are the five more prominent chromomeres repeated in approximately the same relative sizes and positions,— as shown in figure 97, where corresponding granules are connected by dotted lines,— but there is likewise a striking correspondence in the more minute details. For example, the segment between the granules numbered 3 and 4 always contains two pairs of granules of about the same relative size, though they vary somewhat in relative position. On the other hand, the segment between 2 and 3 is characterized by the entire absence of any prominent granules. In some cases, however, as in *f*, *i*, and *k*, figure 97, granules can be made out in this segment, and when this is possible there are always two pairs of very small ones in the same relative positions.

It is true that there are some variations in the appearances of the segments between granules numbered 1 and 2 and between 4 and 5, as well as differences in the actual size of the numbered granules.

These variations may be due to one or more of several causes: — (1) Differences arise on account of slightly different reactions to the fixatives and stains. (2) There is a tendency for adjacent granules to fuse, thus causing apparent variations in number and relative size. (3) There is a slight difference in appearance at different stages. (4) The different positions assumed by the element with reference to the optical axis of the microscope may account for some variation in appearance. (5) Some individual variation from animal to animal might be expected.

It will be noticed that the distal granule (no. 5) is single in all the individuals except those represented at *b* and *c*, where it is double. This is in accordance with the statement previously made (page 70) that chromosome-pair *B* is unequal in eleven and equal in only two of the thirteen animals studied. It will also be noticed that the granules at the proximal end (no. 1) frequently become associated with other polar granules in a composite granule (*a*, *h*, *i*, *j*, *l*, *m*, fig. 97), and that with one exception (*f*) the distal end is free. The formation of composite granules is a characteristic feature of this material, as already noted on page 64.

One of the granules of the proximal pair (no. 1) of individual *f*, figure 97, is seen to be enlarged and less deeply stained than its mate. Another example may be seen at *k*. I believe this to be an example of a modification similar to that described in connection with the distal granules of the pair *A* (p. 66). In *B*, this condition appears with much less frequency, for in a count of 84 cases taken at random from one individual only 14 ($16\frac{2}{3}\%$) had one of the granules in the expanded condition. This modification may persist into the tetrad stages, as was the case with *A*. No case was found in which both granules were expanded.

In order to test the variability of the details of constitution of the element *B* in a single animal, a study was undertaken with this object in view. Sixteen drawings (fig. 98, *a*–*p*) were made of examples taken at random from a single slide. Comparison shows about the same degree of constancy in the composition of the elements here as in the set from different animals. Some of the variations may be pointed out. For example, the relative lengths of the segments 1–4 and 4–5 in example *a*, figure 98, are somewhat different from those in example *h*. I think we may assume that the spireme threads possess some elasticity and that the variation in arrangement, association, and position of the several segments of the spireme may frequently bring about stresses which may stretch some of the threads or parts of threads to a greater or less degree. The tendency for adjacent granules to fuse probably accounts for some of the variations to be noticed. If one will compare in order the examples *l*, *m*, *a*, and *c*, (fig. 98) the different steps in the fusion of granule no. 4 with the smaller, yet prominent, granule close to it will be seen. As the threads shorten during the later pachytene and postspireme stages, this coalescence of adjacent granules becomes more noticeable and the individual granules all finally lose their visible identity in the compact metaphase chromosomes.

It will be observed that the members of a pair of granules may also appear to be fused together into a single mass. An example of this is seen in figure 98, *n*, granules 4 and 5. This fusion must be very temporary in character, since it is not the general rule, and since the granules separate again in the postspireme stages, as shown in figure 63 (Plate **6**); yet so close an association of these granules apparently offers opportunity for the exchange of chemical substances between them. In the case of the proximal granules (no. 1), the members may not only fuse with each other but, as previously noted, characteristically unite with the polar granules of other chromosome-pairs to form the composite granules. The association is fully as close as in that of any single pair, for frequently all traces of the outline of individual granules is entirely lost, as, for example, in figure 34 (Plate **3**). Although the individual granules separate out again in the postspireme stages, if we admit that there is an exchange of chemical substances between members of a single pair of granules, I think we must also assume it for the polar granules of the different chromosome-pairs.

At *j* (fig. 98, Plate **8**) may be seen another example of an expanded polar granule, such as has already been mentioned. The possible significance of this peculiarity will be discussed on page 112.

It will be instructive to compare the members of particular pairs of granules. Figure 58 (Plate **5**), as already mentioned, represents a zygotene stage. The paired chromatic threads near the middle have just begun to conjugate, while in the case of chromosome-pair *B*, in the left half of the figure, the two conjugating threads have only recently come to lie side-by-side, for the members of the different pairs of granules are yet distinct. This condition fortunately gives us an opportunity to compare the relative sizes of the members of each pair. On examination it will be seen that the members of the pair numbered 4 are not equal in size. This is also true for the pair numbered 3. In the case of number 4, the disparity in size between the two granules is considerable, and it is interesting to observe that this difference in size can frequently be noticed throughout the pachytene stages. Examples of this may be seen at *b*, *e*, *i*, *l*, and *o* in figure 98 (Plate **8**), which are drawn from the same individual as figure 58. Similar conditions are also to be found in other individuals, as will be seen in figure 97, *a*, *c*, *e*, *j*, and *l*.

This pair of chromosomes can be recognized in the spermatogonia by the presence, in the telophase, of the three most prominent granules, those I have numbered 1, 4, and 5 in the pachytene stages. Examples of such telophases are represented in figures 87–96. In two cases, where the chromosomes had become considerably elongated in the general diffusion process of the telophase, I was able to make out granules 2 and 3 also with their characteristic relative positions and sizes. These are shown in figures 95 and 96. Where both chromosomes of the pair are recognizable in the same nucleus, there seems to be in every case a difference in size between the two middle granules (no. 4). This difference is probably directly related to the difference noted in the zygotene stage (fig. 58) and the pachytene stages (figs. 97 and 98).

Thus, aside from finding a striking degree of correspondence in the minute organization of the chromosome-pair *B* for all the individuals studied (in the pachytene stages), it has also been possible to trace the pair through all the stages from the spermatogonia to the spermatid, except in the preleptotene and leptotene stages. Figures 30 (Plate **3**) and 58 (Plate **5**) show that conjugation is completed at a relatively early stage in the zygotene. This precocious conjugation is possibly facilitated by the relatively small size of this pair. The failure to recognize the pair in the leptotene and immediately preceding stages is probably due to the fact that it has not so great a differential staining capacity as has pair *A*, and to the lack of sufficiently long continued study with this object in view.

A further peculiarity of chromosome-pair *B* may be seen upon an examination of figures 99 and 100 (Plate **9**). There it will be seen that one end of the tetrad has a peculiar roughened or brush-like appearance, to which McClung (**'14**) has already called attention. It will be noticed in the same drawings that the accessory chromosome also presents a similar appearance. Furthermore, a like condition is to be seen at the longer end of *C*, as shown in figure 100, and at the end of some of the other autosomes, as seen in figure 99. The roughened contour of the accessory in both metaphase and anaphase of the first spermatocyte division was noted for Phrynotettix by Miss Pinney (**'08**), and has been described for other species of Orthoptera, for example by Davis ('08) for Dissosteira and Stenobothrus, and McClung ('14) for various Acrididae. But no one, so far as I am aware, has described such a condition for any of the autosomes. Figure 99 is from a slide that had been treated with Heidenhain's iron-haematoxylin stain, but the destaining process had been carried farther than in most of the other slides. Figure 100 is from another individual, the slides of which had been stained by Flemming's tricolor method, but had not been excessively differentiated. It will be noted that the autosomes in this figure do not exhibit the roughened synaptic ends that are seen in figure 99. It seems probable, therefore, that differences in the staining process may have much to do with the appearance or non-appearance of the roughened condition. In heavily stained slides even the accessory, as well as the tetrads *B* and *C*, may appear with a smooth contour. In this connection, I may call attention to these several points: — (1) Tetrad *B* is unequal in both the cases figured and the roughened end corresponds to the large distal granule on the larger conjugant (see fig. 64, Plate 6). (2) Tetrad *C* is likewise unequal and the roughened end also corresponds with the large distal granule at the end of the larger of the two components (see fig. 65). (3) The polar granules usually occur at the proximal end, *i. e.* the end to which the spindle-fibers attach, and therefore the roughened tips of the autosomes in figure 99 probably correspond to the polar granules of these elements. (4) The accessory chromosome and the polar granules have the common property of remaining condensed while the rest of the chromatin is diffuse, as well as the common property exhibited in these two figures (99 and 100, Plate 9). The suggestion therefore offers itself that there may be some common physical or chemical properties underlying the correspondence in behavior between the accessory and the polar granules.

3. *Chromosome-pair C.*— The drawings of chromosome-pair *B* in figure 64 (Plate 6) and those of *C* in figure 65 were made from sections cut from the same testis. An examination of the spermatogonial telophases of this individual revealed the larger members of each of these pairs very well defined, as indicated in figures 101–105 (Plate 9). No attempt was made to recognize the smaller members of these pairs, because they lacked characteristics, other than size, distinctive enough to make recognition certain. With the larger members of these pairs, however, the distinguishing features are so pronounced that I think there can be no doubt about the identification.

I did not attempt to follow these elements through the preleptotene and leptotene stages, but I have no doubt that careful enough study would enable one to trace them, as was done in the case of chromosome-pair A. It is a matter of no small importance, I believe, that each of the "selected" chromosome-pairs has been recognizable by means of one or both its members, in the spermatogonia as well as in the spermatocytes.

On the other hand, when I came to search through the postspireme stages of the other individuals for tetrad C, I was able to find the condition shown in figure 65 in only two instances; but a careful study of these stages in the remaining animals of the series revealed, in place of the large unequal type shown in figure 65, two other types, which are shown in figure 107, *c–m*. Figure 106 presents an example of tetrad B from each of the thirteen animals from which material was available for study, and figure 107 a similar series of tetrad C. The corresponding letters, *a*, *b*, *c*, etc., in the two series represent the same animal. We may therefore, speak of the different animals as *a*, *b*, *c*, etc. Chromosome-pairs B and C are the smallest in the whole complex and it will be seen from these two series of drawings that, except in *a* and *b*, the pair C is the smaller of the two. In *a* and *b*, C is slightly larger than B, as was determined by numerous comparisons in the metaphases of the first spermatocytes. The difference in quantity of chromatin in these two cases is quite small, however, and differences in shape and behavior were largely depended on for identification.

For convenience in description, we may designate the three types of chromosome-pair C as C_1, C_2, and C_3. By C_1 will be indicated the type, previously described, which is represented in figure 65, and at *a* and *b* in figure 107. The type shown in figure 107, *c–h*, may be designated C_2, and that shown in figure 107 at *i–m*, as C_3. Thus it will be seen that (with a possible exception yet to be discussed) of the thirteen animals studied, two exhibited the type C_1, six the type C_2, and the remainder, five, the type C_3.

If now we compare types C_1 and C_2, it will be apparent at once that both members of the pair C_2 resemble the smaller member of C_1. The homology is striking if one notices the polar granules and the pair of granules close to them, both of which appear in about the same relative size and position in all the examples of both types (except *h*). It is therefore not difficult to believe that type C_2 does actually represent a pair of chromosomes homologous to the smaller conjugant in type C_1.

Turning to type C_3, as shown in figure 107, *i–m*, it will be observed that this is quite different from either C_1 or C_2. It represents an unequal pair but the larger member is very different from the larger one in type C_1. Furthermore the prominent chromomere near the polar granules does not seem to be present, except possibly at *m* (fig. 107). On the other hand the smaller conjugant resembles those in C_2 in size and otherwise except for the prominent granule already mentioned. We might therefore be led to suppose that the smaller component in C_3 is homologous to the smaller one in C_1 and the two small ones in C_2. But if the example at *h* (fig. 107) be regarded, it will be seen that this is a small pair lacking any prominent chromomere near the polar granules, and might therefore be thought to be homologous with the smaller conjugant in type C_3, if it be considered different from those in type C_2. However, even if the somewhat questionable position of example *h*, be disregarded as to homologies, it still must be admitted that we have at least three different types of chromosomes appearing in these examples of tetrad *C*. I may again point out that there is no chance of making a mistake as to the identity of these elements, for the chromosome-pairs *B* and *C* are the smallest pairs in the complex, and the different types of *C* are mutually exclusive, that is, no two of them are ever found in the same animal. I might further add that all the drawings were carefully outlined with a camera lucida and the details filled in so as to represent as accurately as possible the actual conditions as seen in the microscope. The matter of the possible recombination and redistribution of these different types is discussed on page 121.

b. The Accessory Chromosome.

The accessory chromosome has not been made an object of special study here. Since it has been so thoroughly and so frequently described for orthopteran material, it will suffice to give only a brief account of it in this connection. In the first place, it should be stated that the accessory can be recognized as a distinct chromatic individual at practically every stage from the primary spermatogonia to the spermatid. The fact that it forms a large and faintly staining vesicle or "sac" in all the spermagonia except the last, probably accounts for the occasional statement that it can be first recognized in the telophase of the last spermatogonia, where it appears as a condensed mass of chromatin, or a chromatin nucleolus.

Two points deserve to be emphasized: — (1) The accessory, more than the other chromosomes, maintains an exclusive individuality in nearly all stages. However, it sometimes does become associated with other chromosomes, especially in the growth-period. Here its polar granule may unite with those of the other chromosomes to form a composite granule. (2) Its behavior, while unique in many respects, differs from that of the autosomes in the degree and the chronology, rather than in the kind, of its changes. The autosomes form vesicles in the telophase of the spermatogonia, as Sutton ('**00**) long ago pointed out, just as does the accessory, but they are not quite so large or persistent as with the latter. In the growth-period the accessory forms a looped spireme, just as the autosomes do (see fig. 71 and 72, Plate **6**), but its thread is much more dense and heavily stained than the others. Although it fails to find a mate in synapsis, its behavior is very like that of the autosomes and its spireme loop may occupy the entire circumference of the nucleus. The process of shortening and thickening, which all the chromosomes undergo, occurs very early in the case of the accessory and it passes through most of the growth-period as a rather compact mass of chromatin. In the postspireme stages, at the time when the chromatids separate from each other by the formation of the secondary longitudinal split, the accessory forms a more or less bent or twisted rod, which often shows a longitudinal split. This split must be homologous to the secondary split seen in the autosomes, which divides longitudinally each of the chromosomes united in synapsis. In the anaphase of the first spermatocyte division its halves separate at the distal end, so that it forms a dyad similar in all respects to those of the autosomes, except for its more roughened condition. In fact, the accessory dyad cannot always be distinguished from the others in the late anaphase. In the metaphase of the secondary spermatocytes it divides along with the autosomes and usually is indistinguishable from them. Its behavior may therefore be more nearly parallel to that of the whole series of chromosomes than we are sometimes led to suppose.

c. *The Spermatogonial Divisions.*

Let us now consider the subject of persistent chromosomal organization from the standpoint of the spermatogonial divisions. Figures 1–20 (Plates **1** and **2**) are intended to represent the most important stages included in the cycle of changes from one cell division to the next. In this description no reference will be made to the selected chromosomes, but the general behavior of the chromatin material will be considered. We shall also leave out of account the mechanics of the division process and concern ourselves chiefly with the fate of the chromosomes after their division and separation has been accomplished.

In my account of the accessory chromosome, I have already mentioned the formation of sacs or vesicles in the telophases of the spermatogonia. In an early telophase, such as is shown in figure 5 (Plate **1**), the chromosomes are clumped together in a rather compact mass at the pole of the spindle. But the distal tips of the larger chromosomes may be seen projecting in various directions. Following the clumped condition, stages occur during which the chromosomes begin to expand and to separate from one another. At the same time there is developed about each chromosome a hyaline area, at first small in extent, but gradually enlarging as the chromosomes continue to expand. These conditions are shown in figures 6–9. Figure 6 is a side view and figure 7 a transverse (optical) section of the same stage. Figures 8 and 9 are likewise side view and optical section, respectively, of a later stage. At this later stage it will be seen that a membrane has been formed at the boundary between the hyaline area and the cytoplasm. We are therefore probably dealing with sacs or vesicles similar to those described by Sutton ('**00**) for Brachystola.

What is the origin of these sacs? Does the hyaline region as it first appears represent material from the cytoplasm, or from the chromosomes, or is it an artifact resulting from the contraction of the chromatin under the influence of the fixative? That it is not an artifact, will be apparent, I believe, from the following considerations: — (1) The chromosomes themselves, at the stages shown in figures 6 and 7, are larger than in the earlier stages represented in figures 3 and 4. (2) The chromosomes continue to expand and the vesicles expand still more rapidly, as will be seen from the later stages (fig. 8 and 9). (3) The hyaline region as seen in figures 6 and 7 appears more highly refractive than the cytoplasm which would not be the case if it were a space produced by shrinkage of the chromatin.

A comparison of the conditions shown in figures 6 and 7 with those shown in figures 10 and 12 will, I believe, show that the expansion of the vesicles has been at the expense of the cytoplasm. The relative volume of the space within the vesicle as compared with the volume of the cytoplasm, is much less in these earlier stages (fig. 6 and 7) than in the later stages (fig. 10 and 11). Further, it will be seen that the expansion of the vesicles is accompanied by: — (1) an increase in the size of the cell-body, (2) a diffusion of the chromatin into a kind of reticulum within the space of each sac, (3) the breaking down of the vesicular membranes between adjacent vesicles within the group, especially at the polar end, (4) the formation of an irregular nuclear membrane from the outer walls of the vesicles, (5) the apparent anastomosing of the edges of the networks arising from the diffusion of the chromosomes in adjacent vesicles. The walls bounding the original vesicles are still to be seen in figures 8–13, and this is particularly true of the accessory chromosome, the vesicle of which persists till a late prophase.

What can we now say as to the continuity of the individual chromosomes? Let us first follow the changes undergone by the accessory chromosome. Figures 1 and 2 are of metaphases, in which all the chromosomes except the accessory are compact and smooth in outline. This is roughened in outline and seems to have already begun the process of expansion which characterizes its behavior immediately after division. In figure 4 a hyaline area of considerable extent has already been formed about the accessory, and close examination reveals also a narrow hyaline area just beginning to develop around each of the autosomes. By the time the stage shown in figure 6 is reached, the substance of the accessory has become distributed through the entire space of the vesicle which accompanied the formation of the hyaline area. In its distribution within the vesicle, the chromatic substance is more concentrated on the periphery of the sac, than through the central space. The vesicle continues to expand along with the expansion of the nuclear material as a whole, until the stage of greatest diffusion of the autosomes has been reached (fig. 12 and 13). At the stage shown in figures 14a and 14b (Plate 2) the chromatin has begun to concentrate towards the axes of the sacs, but this process seems to be less advanced in the accessory (*X*, fig. 14b) than in the autosomes. These are the earliest of the prophases. In the later prophases, as shown in figures 17 and 20, the accessory becomes concentrated as a coiled thread running down through the middle of the vesicular space. The wall of the vesicle persists longer than does that of the nucleus as a whole or that of the other autosomes (fig. 20). There can be no question, it seems to me, that the accessory maintains a persistent individuality through all these stages.

If now the changes undergone by the autosomes be followed, we shall find for them also evidences of persistent individuality. I think no one would deny a persistent individuality up to the stages shown in figures 8 and 9 (Plate 1). In these figures the chromatin has become reticular, but the masses representing individual chromosomes are still quite distinct and surrounded for the most part by the persisting walls of the vesicles. The method of formation for these vesicles parallels very closely that described for the accessory, the chief difference being that in the case of the accessory the process is much more rapid. In figures 10 and 11 we find the chromatin much diffused and occupying most of the space within the original vesicles. The vesicular walls are no longer visible, however, except on the periphery as an undulating nuclear membrane, and around the accessory. In spite of this fact, the chromatic masses or blocs, each of which has arisen from a single chromosome, are still recognizable as distinct from one another. This is especially well shown in the optical section drawn in figure 11. There are only eighteen masses shown in this section, but the apparent reduction in number need cause no apprehension as to the fate of the other members of the complex. It frequently happens that the chromosomal vesicles do not all lie parallel to each other, so as to be represented in a single transverse section, and some may even assume a position at right angles to the axis of the majority. Such a case is shown in the upper left-hand corner of figure 10. If, now, we examine the stages shown in figures 12 and 13, which are of the period of greatest diffusion that I have been able to find, we may still see, both in optical section (fig. 13) and in side view (fig. 12), the positions of the individual chromosomes represented by a more condensed band or core. In the case of the optical section, nearly the complete number of chromosomes, as represented by these denser masses or cores, can be counted. It is true that there seems to be an anastomosing system of fibrils connecting the adjacent masses, but this need not mean that there has been a loss of chromosome-identity in a common nuclear mass.

An early prophase is represented by figures 14a and 14b (Plate **2**), which show the two sections of a single cell. We see at this stage the beginning of the process of chromatin concentration which results, finally, in the formation of the condensed chromosomes ready for the next division. The chromatic material of each chromosome first concentrates near the middle of the region that it occupied in the nucleus in the diffuse condition. There is thus formed a loosely reticulated core (fig. 14a and 14b), out of which there develops a spirally coiled thread, as shown in figures 15a and 15b. The two stages represented in figures 14 and 15 are very close together in time, for they occurred side-by-side in the same cyst. These coiled threads are at first rather small in diameter, but they rapidly thicken and shorten, as indicated in figures 16–20 (Plate **2**). During the process of shortening and thickening the outlines of the vesicular walls become more distinct. This is especially true of the distal pole, as shown in figure 18. It would seem, therefore, that the vesicular membranes first became formed, then largely disappeared, and later reappeared in part. I am inclined to believe that they actually persist to a greater extent than is apparent. There cannot be any doubt, however, that the vesicles do coalesce at the polar end of the nucleus, for there the individual polar granules frequently fuse to form composite granules, such as may be seen in figure 12 (Plate **1**) and figures 14, 15, 16, and 19 (Plate **2**).

The first indication of the longitudinal split which forecasts the next mitosis was discernible at a stage such as is shown in figure 17. From this stage on to the metaphase, however, the split was clearly visible.

I believe that the evidence here presented furnishes very good grounds for believing that the chromosomes do not lose their individuality in passing through the so-called 'rest-stage' between the two successive cell-divisions.

d. The somatic Nuclei.

Only slight attention has been given to somatic cells in connection with the subject of the individuality of chromosomes, but some points were noted which it seems worth while to record. The connective-tissue nuclei within the follicle always divide by the indirect or mitotic method. The details are similar to those just described for the spermatogonia, except that individual chromosome-vesicles, even for the accessory, are less conspicuous — in fact, in my limited study of these cells I have not recognized the accessory chromosome with certainty. The only evidence of amitosis is a lobulated condition of the resting nuclei; that condition is a very characteristic one, but has no more significance as to amitosis than the lobulated appearance of the spermatogonial nuclei. In the diffused chromatin-stages — telophase, rest-stage, and early prophases — the polar granules appear, coalesce more or less to form composite granules, and separate out again just as they do in the spermatogonia. Furthermore, it is possible to find chromosomes in the telophases that exhibit all the chief characteristics of the "selected" chromosomes. For example, in Plate **9**, *B*, figures 108, 109 and 110, are to be seen diffusing chromosomes with the characteristic features of one of the larger members of chromosome-pair *B*. It would seem from this evidence that the same morphological constitution of individual chromosomes persisted even in these somatic cells.

Going outside the follicle, it is of interest to note what appears in the nuclei of the follicular investment. This investment is a thin membrane inclosing the follicle, forming the outer of the two layers composing the follicular wall. In this membrane the nuclei are very much flattened, so that the chromosomes lie nearly all in one plane. Figures 111 and 112 indicate the chromatic conditions in two such nuclei. It is, I believe, a significant fact that the chromatic masses to be found in these nuclei are in number approximately equal to the unreduced number of chromosomes found in the spermatogonia. Exceptions, it is true, occur; adjacent chromosome-masses may become intimately associated, or one individual mass may become divided into partially separated masses. These nuclei are fully differentiated and are destined never to undergo another cell-division. They must gradually lose their functions and will finally "die in their tracks." The different conditions of the chromatin in the different nuclei suggests that the process of senescent degeneration may have already set in. The important fact still remains, that the individual chromosomes have a tendency to remain distinct from each other, even in these highly differentiated nuclei in a period not only of 'rest' but perhaps of senescence.

D. Summary of Observations.

1. The general topographical relations of the different generations of male sexual cells in the testes of *Phrynotettix magnus* are typical for the Acrididae.

2. For purposes of accurately following the history of the changes undergone by the chromosomes from the pachytene stages of the first spermatocyte to the time of mitosis, three individual chromosome-pairs were selected, each of which possessed characteristics by which it could be recognized in all the stages concerned. These three pairs were designated, for convenience, "*A*," "*B*," and "*C*." A study of these three chromosome-pairs showed: — (a) that there is a longitudinal split in the pachytene stages, which persists into the tetrad and later stages (this is called the primary longitudinal split); (b) that a tetrad is formed out of a spireme segment by (1) a separation along the primary split, and (2) the appearance of a secondary longitudinal split along the middle of each of the two parts separated by the primary split.

3. Tetrad "*A*" opens out along the plane of the secondary split,

the proximal ends separating and moving about 90 degrees apart, so that a rod-shaped element is formed the middle of which represents the distal end of the original segment. The rod, thus extended, becomes oriented with its long axis parallel to that of the spindle and it separates in the middle, thus bringing about an equational division. Tetrad "*A*" also forms rings, but these were not traced into the metaphase, and their later behavior is not known.

4. Tetrad "*B*" occurs in one or the other of two forms: either (1) as an equal pair (in two of the thirteen animals), or (2) as an unequal pair (in the other eleven animals). The unequal pair differs from the equal in the absence of a large terminal granule at the distal end of one of its members. Both types show the same behavior, opening out at both ends of the segment so that a cross is formed. The separation along the plane of the primary split is the greater and occurs at the distal end; but the cross becomes so oriented on the spindle that the short arms (*i. e.* the proximal end of the original segment) are attached to the spindle-fibers. Separation in metaphase is therefore along the plane of the secondary split, thus constituting an equational division.

5. Tetrad "*C*" occurs in three forms, designated C_1, C_2 and C_3. C_1 is composed of very unequal elements, the larger of which possesses a relatively very large terminal knob or granule that is not present on the other. C_2 is a pair with equal members each of which appear to be homologous to the smaller member of C_1. C_3 is a pair of unequal elements neither member of which appears to be exactly homologous to the components of C_1 and C_2. The smaller member resembles those of C_2 and may be homologous to them. The larger member is midway in size between the two members of C_1. C_2 and C_3 divide equationally in the first maturation mitosis, but C_1 divides half the time equationally and half the time reductionally in this first division. When dividing reductionally the two unequal dyads follow the law of chance in their distribution with reference to the accessory chromosome, which passes to one pole undivided.

6. Study of the early growth-stages of the first spermatocyte shows that each of the chromosomes of the telophase of the last spermatogonial division forms a long spirally coiled thread, which uncoils and stretches out to form the leptotene threads of the primary spermatocyte. The leptotene threads conjugate side-by-side (parasynapsis) to form the double threads of the pachytene stage.

7. It was possible to recognize the chromosome-pair *A* in the spermatogonia as two separate chromosomes (telophases) and to

trace the pair through all the stages from the spermatogonia to the spermatids, thus constituting a demonstration of a case of continuous identity, or individuality, through these stages. It was also possible to recognize chromosome-pairs *B* and *C* in the spermatogonial telophases as well as in the second spermatocytes and spermatids.

8. In the earlier pachytene stages, chromosome-pair *B* was found to have a definite arrangement of granules or chromomeres, and it was shown that the relative sizes and positions of these chromomeres remained constant for similar stages, not only in different cells of a single individual, but also in all the thirteen animals.

9. The spermatogonial divisions showed that each chromosome forms a sac or vesicle in the earlier telophases, and that it expands and becomes diffused within these vesicles; that, although the vesicles appear to coalesce, there is always a remnant of each chromosome visible in the center of the region occupied by the vesicle, and that in the prophase the chromatin concentrates about this remnant or core and there forms a spirally coiled thread, which develops into a prophase chromosome.

10. Study of somatic cells showed: — (1) that chromosome *B* could be recognized in the connective-tissue cells within the follicle, and (2) that cells of the follicular envelope, which are probably in a state of senescence, still preserved the normal number (23) of chromatic masses.

11. The polar granules are constant features of the organization of the individual chromosomes, as was shown by Pinney (**'08**); but in some cases (chromosome-pairs *A* and *B*) they may become modified to give rise to expansions which resemble the "vesicles" described by Carothers (**'13**), as well as the "plasmosomes" of most authors. The polar granules tend to unite into composite granules at all of the diffuse stages of chromatic evolution.

12. The accessory chromosome behaves in the manner that is typical for the Acrididae. It forms a large separate sac or vesicle in the earlier spermatogonial generations and a peripheral compact mass in the telophase of the last spermatogonial division. During the leptotene and zygotene stages it may unravel into a long loop, which in some cases is equal in length to a great circle of the nucleus. In the pachytene stages it reassumes a compact form, but may be attached by its polar granule to the polar granules of other chromosomes and thus become attached to a composite granule. It passes to one pole undivided in the first maturation division but divides in the second.

III. DISCUSSION.

A. Synapsis and the Maturation Divisions.

It is very difficult to separate the subjects of synapsis and the maturation divisions from the subject of chromosome-individuality. Yet for the sake of clearness it seems best to make such an artificial separation. It might also be possible to separate from each other the subjects of synapsis and maturation divisions, but since the two are so intimately related, it seems better to discuss them at the same time.

Anything like a complete review of the literature on the subjects of synapsis and reduction divisions will not be attempted here, in view of the extensive general reviews in the monographs of Grégoire (**'05**, **'10**) and Vejdovský (**'11–12**), and the reviews relating particularly to orthopteran spermatogenesis by Davis (**'08**) and McClung (**'14**).

a. Results from Orthoptera.

McClung (**'14**) has so recently reviewed the literature on Orthoptera dealing with this subject that it will suffice here to summarize briefly the results. The different views may be classified as follows: —

I. Synapsis not considered.
  a. Both maturation divisions reductional.
    1. Wilcox (**'94, '96, '97, '01**), Caloptenus.
  b. Both maturations equational.
    1. De Sinéty (**'01**), various Orthoptera.
    2. Granata (**'10**), Pamphagus.
  c. First division transverse.
    1. Vom Rath (**'92, '95**), Gryllotalpa.
    2. Farmer and Moore (**'05**), Periplaneta.
    3. Jordan (**'08**), Aplopus.
II. Synapsis described or assumed.
  A. Telosynapsis described or assumed.
    a. First maturation division reductional.
      1. Montgomery (**'05**), Syrbula.
      2. Stevens (**'05**), Blatta.
      3. Wassilieff (**'07**), Blatta.
      4. Zweiger (**'06**), Forficula.

    5. Davis ('08), Acrididae and Locustidae.
    6. Buchner ('09), Gryllus, Oedipoda.
    7. Stevens ('10b), Forficula.
    8. Brunelli ('09, '10), Gryllus, Tryxalis.
  b. Second maturation division reductional.
    1. Sutton ('02, '03), Brachystola.
    2. Baumgartner ('04), Gryllus.
    3. McClung ('05, '08a, '14), various Orthoptera.
    4. Stevens ('05), Stenopalmatus.
    5. Nowlin ('08), Melanoplus.
    6. Pinney ('08), Phrynotettix.
    7. Robertson ('08) Syrbula.
    8. Carothers ('13), Acrididae.
B. Parasynapsis assumed or described.
  a. First maturation division reductional.
    1. Gerard ('09), Stenobothrus.
    2. Morse ('09), Blattidae.
    3. Stevens ('12a), Ceuthophilus.
    4. Robertson ('15), Tettigidae.
  b. Both divisions equational.
    1. Vejdovský ('11–12), Locustidae.
  c. Division neither reductional nor equational.
    1. Otte ('07), Locusta.

This classification[1] is interesting from two points of view. In the first place, it indicates the diverse results that have been obtained by the various investigators working on a limited group within which one might reasonably expect to find a high degree of uniformity in chromosomal behavior. In the second place, the results that I have obtained do not come under any of the classes in the above outline. As stated on previous pages, I have shown (1) that the spermatogonial chromosomes develop into the fine leptotene threads, which conjugate by parasynapsis without the conjugants losing their identity, that is, the line of conjugation is visible throughout the growth-period as the 'primary longitudinal split'; (2) that a second longitudinal split at right angles to the first occurs in the early postspireme stages; and (3) that the tetrads become so oriented on the first maturation spindle that the resulting division is equational. Each of the dyads of the second spermatocytes consists of parts of the two original conjugants, and these conjugant-halves become separated in the second maturation mitosis, the result being, therefore, a reductional division. I am thus able to support the careful studies of McClung and his students as to the orientation of the tetrads in the first maturation spindle, where the spindle-fibers become attached at the so-called 'synaptic' or proximal ends, and therefore bring about an equational division. I can likewise support the findings of those investigators who describe parasynapsis. If we accept the view that one of the longitudinal splits is in reality the line of separation between parallel conjugants, we can also accept the observations of De Sinéty (**'01**) as to the existence of two longitudinal divisions.

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[1] I have omitted reference to some papers which were non-committal on the points under discussion.

McClung and those of his students who have worked on orthopteran material have derived their results from studies confined largely to spermatogonia and the postspireme stages. There is nothing in any of their figures, however, which would be incompatible with parasynapsis. And the figures by Sutton (**'02**, fig. 5a, 5b, 6 and 7) of early postspireme stages in Brachystola are much more satisfactorily interpreted from the standpoint of a preexisting parasynapsis than from the standpoint of telosynapsis. I may also state that I have recently examined some Brachystola material and am well satisfied that the conditions there are quite comparable to those prevailing in Phrynotettix. McClung in his latest paper (**'14**) accepts the possibility of parasynapsis, and Robertson, who in 1908 argued for telosynapsis in Syrbula in no uncertain terms, has recently found parasynapsis in the Tettigidae (Robertson, **'15**).

A glance at the outline of the results of orthopteran studies given above reveals the fact that parasynapsis has relatively few adherents. I believe the failure to recognize this important stage has been due (1) to the general unfavorableness of these synapsis, or lepto-zygotene, stages for the elucidation of the conditions and a consequent failure properly to interpret them, or (2) to attention having been largely confined to the postspireme stages. That a study of the latter stages could allow of quite diverse interpretations, I am keenly aware, for it was not till I undertook to follow the history of individual chromosomes that I was able to arrive at any satisfactory conclusion as to the sequence of events. I am confident that the use of the same method on other material will reveal conditions similar to those that I have described for Phrynotettix.

Where the chromosomes differ among themselves as to shape, as they do in Stenobothrus, another source of confusion is encountered, for very few authors have recognized the fact that chromosomes of different shape may behave differently in their orientation on the maturation spindles. McClung has recently gone over this matter in a very painstaking way, and I can agree with his conclusion that, in general, the chromosomes with the spindle-fiber attachment terminal, that is, rod-shaped chromosomes, are oriented in the first maturation spindle so as to produce an equational division, while those which have the spindle-fiber attachment non-terminal, that is, at the apex of V-shaped chromosomes, become oriented so as to bring about a reduction at the first division. This general rule is of course violated when the pairs of rods are of unequal length, which usually (Baumgartner, '11; Payne, '12; Carothers, '13; Robertson, '15), but not always (C_1, described in this paper), divide reductionally in the first division. Davis ('08) sought to establish the behavior of the V-shaped chromosomes of Stenobothrus as the type for the Orthoptera in general. He correctly described the behavior of these chromosomes in the maturations, but fell into error by attempting to make the rod-shaped chromosomes conform to the same type of behavior. He also failed to recognize parasynapsis. I have recently made a study of the conditions in Stenobothrus and may say that I found parasynapsis for both forms of chromosomes, and that the V-shaped chromosomes divide reductionally in the first maturation mitosis, as Davis described, but that the rod-shaped chromosomes divide equationally in the first division, as I found that they did in Phrynotettix.

b. Recent Work on Synapsis.

That parasynapsis has a wide occurrence, is evident from a glance at the cytological literature, especially within recent years. Grégoire in his two admirable monographs ('05, '10) has reviewed most of the previous literature bearing on the subject of the behavior of the chromosomes in maturation, and has endeavored to find a common type of behavior for both plants and animals. He says ('10, p. 384): "Dans un bon nombre d'objets animaux et végétaux, les cinèses de maturation s'accomplissent suivant le type d'une *prêréduction hétéro-homéotypique* préparée par une *pseudo-réduction prophasique par parasyndèse ou zygotènic.*" In this "hètèrohomèotypique" scheme, however, Grégoire has failed to distinguish the difference in behavior between the chromosomes with terminal and those with non-terminal spindle-fiber attachment. Since the publication of Grégoire's later monograph, a considerable number of investigators have reported the existence of parasynapsis.

De Saedeleer (**'13**) finds in ASCARIS all the typical stages of the growth-period:—leptotene, zygotene, pachytene, and diplotene; he consequently believes that parasynapsis occurs.

Among the CRUSTACEA parasynapsis has been found by McClendon and by Kornhauser for Copepoda and by Fasten for Cambarus. McClendon (**'10**) found parasynapsis in both the oögenesis and the spermatogenesis of *Pandarus sinuatus,* but could not decide which of the maturation divisions were reductional. Kornhauser (**'15**) gives a very full account of a careful study of the process of parasynapsis in *Hersilia apodiformis,* thus confirming the earlier results, as to the existence of parasynapsis in Copepoda, of Lerat (**'05**), Matschek (**'09**), and McClendon (**'10**). In this paper he clears up the uncertainty in regard to this group brought about by the unique theories held by Häcker (**'92**) and his followers. Kornhauser demonstrates very clearly that the so-called 'Querkerbe,' which Häcker and his followers interpreted as the point of end-to-end union, is nothing more than the synaptic point of the chromosomes which have a median or non-terminal spindle-fiber attachment. The Copepoda are thus brought into line with the majority of other forms. Fasten (**'14**) finds parasynapsis in Cambarus, and although he is dealing with a very large number of chromosomes (the diploid number is about 200), his figures of the leptotene and zygotene stages are quite convincing.

With respect to work on insect material, I have already mentioned that on ORTHOPTERA. The results of Stevens are unusual in that she has described telosynapsis for Blatta (**'05**), Stenopalmatus (**'05**), and Forficula (**'10b**), while in Ceuthophilus (**'12a**) she found parasynapsis. In the last mentioned article she says (p. 227) "I should not be surprised if the range of variation should prove to extend from (a) cases where there is nothing that could be called conjugation, but merely such a pairing without contact even, as will secure segregation of homologous maternal and paternal chromosomes to different daughter cells, through (b) an intermediate condition of telosynapsis and less intimate parasynapsis, to (c) cases where homologous chromosomes are so completely fused in parasynapsis that it is impossible to tell whether the resulting chromosomes which are segregated in mitosis are identical with those that went into synapsis or not." It may be that more intensive studies will reveal greater uniformity of behavior than Stevens advocated.

Payne (**'14**), in a brief description of tetrad formation in Forficula sp., reaches only tentative explanations and conclusions. He finds a variable number of chromosomes in the two maturation divisions and suggests that this might be accounted for by supposing that some of the spermatogonial chromosomes had failed to pair. He describes two methods of ring-formation. The correctness of his conclusions as to the succession of stages in some of his series might be questioned on the ground that they are not different stages of the same chromosome. The series shown in his figures 2 to 11 probably represents a normal method of ring-formation, viz., by the opening out of a parasynaptic spireme segment along one of the longitudinal splits, with the ends remaining in contact. The series in figures 12 to 16 might also easily be derived from a parasynaptic segment. It is extremely questionable whether the figures in the series 18–20 are arranged by the author in their natural sequence; the reverse order is more likely to be the correct one. His figures 19 to 27 (Plate **2**) doubtless represent different shapes of the same chromosome-pair, the so-called "middle granule" serving to identify the element. I would suggest, however, that the stage that he represents in figure 19 may have resulted from an opening out of a parasynaptic segment in the same way that I have described for chromosome-pair *A*, in which case the "middle granules" would be polar granules instead of "middle" ones.

In view of the rather far-reaching conclusions that Robertson (**'15**) has drawn from his work on the Tettigidae, I would call attention to some differences, as well as similarities, between his work and mine. In the first place, he describes parasynapsis in the early stages of the growth-period, as I have done, but in the postspireme stages he assumes that the conjugants separate along the plane of conjugation (primary longitudinal split), the separation beginning at the proximal end. He shows in the metaphase of the first spermatocyte most of the chromosomes as elongated rods with appearance and orientation similar to that seen for my tetrad *A*. It will be remembered that in the latter case the separation from the proximal end of the spireme segment toward the distal end is not along the plane of the primary split, but along the plane of the secondary split. I believe that Robertson may have overlooked a similar behavior in the chromosomes of his material. Curiously enough the unequal elements that he describes are very similar to the unequal type of chromosome *B* and of chromosome *C*, in Phrynotettix. I have shown that the behavior of the chromatids in *B* and *C* is similar to that in *A*. And that in the cases in which *C* divides reductionally in the first division the spindle-fiber attachment is necessarily shifted to the distal ends. I believe that such a condition probably occurs in the unequal tetrads described by Robertson, and if so, theoretical explanations, as to how the elements came to be related to each other in the way they are, would be unnecessary. Robertson says he believes that the unequal tetrad in *Tettigidea parvipennis* has arisen by a loss at the distal end. And he finds in other individuals an homologous pair each member of which is equivalent to the larger member of the unequal pair. This is just the condition that is presented by *B* in my material. And, furthermore, by analysis of the pachytene and postspireme stages, I am able to say just what part has been lost.

Another striking analogy between my observations and those of Robertson occurs in connection with the larger unequal pair that he has found in *Acridium granulatus*. He finds in some individuals a small equal pair and in two individuals an homologous unequal pair, the smaller component of which corresponds to either of the two elements of the equal pair. This, again, is precisely the relationship between types C_1 and C_2 in Phrynotettix. Here, too, we both failed to find the other possible combination, namely, that of a pair of the larger conjugants. These striking similarities lead me to think that the elements described by Robertson may be explained in the same way that I have explained them in Phrynotettix. If such be the case, then the various assumptions as to doubling and "sesquivalent" chromosomes will be unnecessary. I believe, further, that without a doubt the unequal tetrads described by Robertson do divide reductionally in the first maturation division, but that the spindle-fiber attaches at the distal and not at the proximal end; and, furthermore, that there is a very good chance that the other chromosomes may behave as does chromosome-pair *A* in Phrynotettix, and therefore divide equationally, as it does.

Of recent works on HEMIPTERA, the most interesting from the standpoint of synapsis are the papers by Montgomery, Wilson, and Kornhauser. Montgomery (**'11**) advocated telosynapsis for many years, but in this late paper, in which he described the spermatogenesis of Euschistus, he concludes that pairing is by a process of parasynapsis. I believe it to be a highly significant fact that Montgomery, at the end of his very active career as a cytologist, and with his wide experience back of him, should reverse his former position on the subject of synapsis and should find parasynapsis in this insect, which he had studied and reported on at an earlier date (**'01**). He says (p. 743): "In the growth period through the pachytene stage there is no longitudinal splitting, for what I had previously (**'01**) interpreted as such, I now find to be the line of conjugation.... Frequently at certain points along a geminus the chromatin granules appear accurately paired. But this does not appear until a rather advanced stage of the strepsinema and is by no means regular" .... Further on (p. 753) he says: — "During the past year I have also convinced myself of the occurrence of parasyndesis in Plethodon, such as Janssens had described for this object and the Schreiners for Salamandra."

Wilson (**'12**), in his critical study of the subject, first states the questions that he believes must be answered in connection with synapsis and then gives his reasons for believing in the wide occurrence of parasynapsis. He regards the following questions as still awaiting a satisfactory answer: — "1. Is synapsis a fact? Do the chromatic elements actually conjugate or otherwise become associated two-by-two? 2. Admitting the fact of synapsis, are the conjugating elements chromosomes, and are they individually identical with those of the last diploid or premeiotic division? 3. Do they conjugate side-by-side (parasynapsis, parasyndesis), or end-to-end (telosynapsis, telosyndesis), or in both ways? 4. Does synapsis lead to a partial or complete fusion of the conjugating elements to form 'zygosomes' or 'mixochromosomes,' or are they subsequently disjoined by a reduction division?"

Wilson finds his own material (hemipteran) not altogether favorable for a solution of the problems enumerated, but has been able to study the preparations of Tomopteris, supplied by the Schreiners, and of Batrachoseps supplied by Janssens. He studied also some orthopteran material, including Phrynotettix, secured from McClung. After a study of Tomopteris and Batrachoseps he says (p. 384): "Through the study of Batrachoseps and Tomopteris I have finally been convinced — for the first time, I must confess, as far as the autosomes are concerned — (1) that synapsis, or the conjugation of chromosomes two-by-two, is a fact, and (2) that in these animals (perhaps also in the Orthoptera) the conjugation is a side-by-side union, or parasynapsis." And again (p. 399), "The few observations I have been able to make on McClung's preparations of Achurum, Phrynotettix, and Mermiria ... lead me to the impression that a side-by-side union of leptotène threads takes place here also."

Browne (**'13**), from a comparative study of the spermatogenesis of three species of Notonecta, regards the evidence, though not absolutely conclusive, as indicating a conjugation by parasynapsis. Kornhauser (**'14**), as a result of a very careful study of the spermatogenesis of two species of Enchenopa, finds conclusive evidence of a parasynaptic union at the beginning of the growth-period. The evidence for parasynapsis in the Hemiptera is thus seen to be very strong.

Of recent work on the Diptera, I may mention that of Stevens and of Taylor on Culex, and that of Metz on Drosophila. Stevens (**'10a**) finds parasynapsis in Culex, not merely in the growth-period of spermatogenesis, but among other kinds of cells. She says (**'10a**, p. 208): — "That parasynapsis occurs immediately after the last oögonial mitosis is certain and it is equally certain that the chromosomes are similarly paired in earlier generations of the oögonia," Again (p. 209): — "In Culex it is quite certain that parasynapsis occurs in each cell generation of the germ cells in the telophase," and (p. 212), "It is interesting to find in Culex a clear case of parasynapsis in oögonia, oöcytes, spermatogonia, and spermatocyte prophases and then to see the same chromosome pairs appearing in the first maturation metakinesis as though united end-to-end." (It is probable that she has overlooked stages in the postspireme showing the changes undergone by a parasynaptic spireme segment in its transformation into a metaphase tetrad). Miss Stevens found six to be the somatic number of chromosomes in Culex, the reduced number being three. The side-by-side pairing of the chromosomes in nearly all generations of cells studied, gave the appearance of a reduced number in many situations where it would not have been suspected. Taylor (**'14**) states that she found in *Culex pipiens* only three chromosomes in all the stages that she studied, *i. e.* in both the somatic and germ-cells of both sexes. This is a very surprising result, but an explanation may perhaps be found in the conditions observed by Miss Stevens, namely, the tendency for the chromosomes in all kinds of cells to pair between mitoses. A poor fixation might easily prevent one from recognizing the double nature of a closely adhering pair of chromosomes. Besides, Miss Taylor found some cells with six chromosomes, and shows figures of some others with more than three. It would seem more reasonable, then, to regard the prevalence of the reduced number found by Miss Taylor as the result of the constantly recurring tendency of the chromosomes to unite side-by-side between successive mitoses, and possibly to poor fixation.

The results of Metz (**'14**) on Drosophila are interesting in this connection, for he reports conditions in these flies similar to those found in the mosquito. In this he confirms the earlier results of Stevens (**'08**). He finds (p. 55) that: — "The chromosomes not only exhibit a close association in pairs at nearly all times, but that before every cell division the members of each pair become so intimately united that they may be said actually to conjugate. Each pair, with the possible exception of the sex chromosomes, goes through what amounts to a synapsis in every cell division, so that in many cases the figures closely resemble the haploid groups. Apparently this takes place especially in early prophase, but a second conjugation may occur during metaphases, just a short time before division. In the second, or metaphase, conjugation, at least, it is worthy of note that the union is unquestionably a side-by-side or parasynaptic one." Thus we find parasynapsis in a greatly exaggerated form in these examples from the Diptera.

Of recent studies on VERTEBRATA, we may note those of Snook and Long on an amphibian, of Jordan on an opossum, and of Wodsedalek on the pig.

Snook and Long (**'14**) find the same kind of evidence for parasynapsis that has been presented for Batrachoseps by Janssens (**'05**), for Salamandra by the Schreiners (**'07**), and by Wilson (**'12**) as quoted at p. 102. This evidence, together with that announced by Montgomery (**'11**) for Plethodon, forms a series of observations which renders very probable a general occurrence of parasynapsis among amphibians.

Jordan (**'11**) describes in the spermatogenesis of an opossum what he considers evidence for telosynapsis. His figures, however, are far from convincing on this point, since they could as readily be interpreted in favor of parasynapsis as telosynapsis.

Wodsedalek (**'13**), in his studies of the spermatogenesis of the pig, is unable to find conclusive evidence on the subject of synapsis. He says (p. 13), however, that in the synezesis stage, "The thin threads become arranged in a very much tangled mass of loops, which later appear in about half the original number and twice as thick." Inasmuch as these phenomena accompany every case of demonstrated parasynapsis, the evidence seems to favor the occurrence of this mode of conjugation in this case.

In conclusion, I think it must be admitted that there is abundant evidence for a widespread occurrence of parasynapsis, especially as shown by the most recent investigations. While a majority of the authors who have worked on orthopteran material have reported telosynapsis, I believe there is some chance that many of them were mistaken, or that a more careful analysis of the critical stages would have given a different result. Whether we accept the hypothesis of Stevens, that all degrees of synapsis occur, or the idea of Grégoire, that parasynapsis is an almost universal phenomenon, we must at all events admit that the most careful of the recent investigations indicate that the latter condition is widespread throughout the animal kingdom.

As to which of the two maturation divisions is equational and which is reductional, no absolute rule can be laid down. The evidence, however, points to the probability that generally chromosomes with terminal spindle-fiber attachment are not separated from each other until the second division, while those that have a non-terminal attachment are separated in the first, and that consequently in the former the reduction occurs at the second division, in the latter at the first division.

B. Individuality.

The theory of individuality was early championed by Van Beneden ('83), Rabl ('85), and Boveri ('88). In more recent years the theory has been supported by many writers, who have accepted as substantial evidence in its favor the constancy in the number, size, and shape of the chromosomes reappearing in the mitotic spindle of any one species of animal or plant. On the other hand, some eminent zoölogists have attacked the theory on the ground that the individual chromosomes cannot be traced through the so-called "rest" period between mitoses. It will, therefore, be convenient to discuss the two topics: — (a) constancy in metaphase chromosomes, and (b) persistent organization of chromosomes.

a. Constancy of Metaphase Chromosomes.

1. *Constancy in number.*— The constancy in number of chromosomes for any species is among the most commonplace of cytological observations. It will therefore be unnecessary to make any extensive references to the literature. Some exceptions to the general rule occur, however, and should receive attention. Supernumerary chromosomes have been reported from time to time, and have been studied especially by Stevens and Wilson. Wilson ('09) found in Metapodius variations in chromosome-number from 21 to 26, though the number for each individual animal was constant. The number of chromosomes was dependent neither on sex, nor locality of habitat, nor was it correlated with constant differences of size or of visible structures in the adults. But the variation affects only particular classes of chromosomes (the small idiochromosomes) and all exhibit the same behavior. Furthermore, Wilson found a few cases of mitoses in which both members of a pair of small chromosome were going to

the same pole. Using this as a basis, he was able to find satisfactory explanation of the variation in number, and one which served to support the theory of the individuality of the chromosomes. Stevens ('12b) found in Diabrotica supernumerary chromosomes varying in number from 1 to 5, and believed that they had their origin in transverse and longitudinal divisions of the X-chromosome, which normally divides only longitudinally. These anomalies can therefore be explained on the basis of some unusual method of distribution of the chromosomes in mitosis; the fact that such extra chromosomes persist in all the cells of the animal in which they are found is a striking bit of evidence in favor of the belief that they maintain their individuality.

Della Valle ('09, '12) has attacked the theory of individuality, declaring that the chromosomes are temporary and variable structures, which form in the prophase and dissolve in the telophase. He thinks their number is the quotient of the quantity of chromatin divided by the average size of the chromosomes. The quantity of chromatin is said to vary with conditions of nutrition, and the number of chromosomes with variations in external conditions. He made counts of chromosomes from cells of the peritoneum of salamander larvae and obtained numbers varying from 19 to 27. Montgomery ('10) points to the following grounds for doubting the accuracy of Della Valle's conclusions: — "1. The chromosomes counted are long, sinuous ribbons, that overlap and interlace, the most difficult kind to count with accuracy. 2. He included in the counts some cells in prophases, where one cannot be certain that all the chromosomes have fully separated. 3. The total number of the chromosomes is so large, about 24, that the chance of error in enumeration is great. It is but fair to conclude that while his technique was excellent, his choice of material was bad, consequently a degree of scepticism might well be maintained toward his results." Della Valle in his latest paper ('12) argues that the chromosomes are variable structures, because he has been able to find transition stages between mitotic and amitotic methods of cell-division in the erythrocytes of young salamanders. It is a well-known fact that amitosis frequently accompanies degeneration, and the figures of Della Valle present strong indications of being those of degenerating cells. It is precisely in degenerating cells that one would look for inconstancy in the behavior of the chromosomes.

2. *Constancy in size and shape.*— It will be convenient to consider the subjects of size and shape together. As to shape, we may distinguish spheres, rods, and V-shaped elements. Spheres are invariably small and may be regarded as short rods. It will be convenient to

include under the term "V-shaped" all the chromosomes which have a non-terminal spindle-fiber attachment. They may be regarded as rods which have become bent at the point of the spindle-fiber attachment. Broadly, therefore, we may look upon all chromosomes as rod-shaped, but it will make description easier to distinguish the types just mentioned.

In attempting to show that chromosomes have a constant size and shape for each species, as well as a constant number, it will be well to call attention to the fact, so clearly stated by McClung (**'14**), that the point of the spindle-fiber attachment is, as a general rule, constant and therefore one of the indications of a persistent organization for each individual chromosome.

Some groups of animals exhibit a high degree of uniformity in the shape and size of the chromosomes in any species, as for example, among the Crustacea and the Amphibia, while others show a great variety of forms (Orthoptera, mammals). In the groups with diverse shapes and sizes of chromosomes, the striking fact was pointed out by Montgomery (**'01**) that there are two of each different size. Montgomery reached the logical conclusion that of the two equivalent series existing in each cell, one had been derived from the maternal and the other from the paternal ancestor.

That the same series of sizes and shapes reappears in each cell-generation, is recorded by nearly every observer whose material is favorable enough to admit of such comparisons. The work of McClung (**'00**, **'02**, **'04**, **'08b**, **'14**), Sutton (**'02**, **'03**), Baumgartner (**'04**), Nowlin (**'08**), Pinney (**'08**), Robertson (**'08**) on orthopteran material has done much to establish this fundamental feature of individuality. A very interesting series of observations on this point is that of Meek (**'12a**, **'12b**) on Stenobothrus. He describes the results of a series of careful measurements of chromosome-dimensions in different generations of cells, and as a result of these observations becomes convinced of the existence of persistent individuality. I may quote some of his conclusions (**'12a**, p. 24, ff.): — "(1) In all metaphases the relative positions of the chromosomes in the equatorial plate appear to be arbitrary. (2) The rods composing all ordinary chromosomes are cylindrical with rounded ends, and of an uniform and constant diameter, viz., 0.83 micra. In each species eight lengths have been found, and these constitute members of a series in arithmetical progression, of which the difference between consecutive terms is equal to the radius of the rod. The heterotropic chromosome does not belong to this general series, for, although equal in length to the longest rod, its diameter varies at different points and exceeds 0.83 micra. (3) The rods are indivisible units, and, since each spermatogonial and second spermatocyte chromosome is composed of two, and each primary spermatocyte chromosome of four, their morphological identity is metrically proved. (4) The eight rod-lengths are not the same in any two species; the longest and 5 short chromosomes occur in all, but identity is always established by the two remaining chromosome-rods. (5) The complexes of a species and its variety appear to be identical; differences if existing, are too small to be recognized. (6) The somatic chromosomes are identical with those of the germ cells. (7) The total volume of ordinary chromosomes is the same in spermatogonial and primary spermatocyte metaphases, whereas only half this amount appears in that of the secondary spermatocyte."

For some zoölogists, the fact that for any species the chromosomes reappear in the different cell-generations possessing the same relations as to number, shape, and size is merely an expression of the activities of the cell and signifies nothing as to a persistent individuality of the chromosomes. Fortunately, we are not dependent on this kind of evidence alone, the results of studies of the chromosomes of hybrids, for example, offering still stronger evidence of individuality, as shown by the work of Moenkhaus on hybrids between Fundulus and Menidia, and that on echinoderm hybrids by Baltzer and by Tenent. Moenkhaus (**'04**) could recognize the two sets of chromosomes arising from the pronuclei of the diverse parents by characteristic differences in size. For the first two or three cleavages the two groups tended to remain distinct, but in later cleavages the chromosomes of the two kinds become more and more intermingled, though they are still recognizable by their characteristic sizes. The value of this evidence is obvious, and on this point Moenkhaus says (p. 53): — "As long as the two kinds remain grouped, as during the first two divisions, this fact has little added significance (*i. e.*, that two groups of distinctly different kinds of chromosomes arise), since within each group it would be perfectly possible for the component chromosomes to exchange chromatin granules during the resting period. If, however, as occurs in the later cleavages, the two kinds of chromosomes become mingled, the chromatin granules of both kinds must lie mingled together within the resting nucleus. If from such a nucleus the two kinds of chromosomes again emerge, it amounts almost to a demonstration that the chromatin substance of a given chromosome forms a unit and that unit persists." Baltzer (**'09**) was able to recognize in hybrids between Echinus and Strongylocentrotus certain chromosomes which were distinctive of the species from which they were derived. Tennent ('08) found in hybrids between Moira and Arbacia a mixture of two kinds of chromosomes, each variety of which could be distinguished. It is, indeed, difficult to understand how these distinctive chromosomes could recur with such definite characteristics in hybrid embryos, if there is no persistent identity for them.

Variations from the general rule of chromosomal constancy have been recorded from time to time, for example, in the shapes of tetrad chromosomes. In many species there is a tendency for each of the forms of the tetrads to be reproduced in the first spermatocyte metaphase. This is particularly true where the chromosomes are all of a similar shape and size. But even in such cases, there is a variation in the exact contour presented by different chromosomes. It has been made apparent by many investigators, especially by McClung and his students, that the shape of a metaphase tetrad is dependent upon the extent and character of the movement on each other of the constituent chromatids. The work of these authors also shows that homologous chromosomes tend to assume about the same shape in all the cells at corresponding stages of mitosis, but that this condition of similarity has its exceptions. Baumgartner ('04) called attention to the constancy in the number of rings formed among the tetrads of Gryllus, and others have noted similar conditions. However, such a criterion for individuality is not always a safe guide, as was pointed out by Foot and Strobell ('05). Commenting on Baumgartner's paper, they say, in regard to chromosomes in *Allolobophora foetida:*—"We find no *constant* form differences of the chromosomes, the simplest form of the bivalent chromosomes is two rods attached end to end, and these present a variety of shapes, rings, figures 8, crosses, etc., without any regularity or constancy. The free ends of the bivalent chromosomes show a tendency to unite into a ring and in some cases nearly all the eleven chromosomes are rings, and sometimes not a single ring is formed" (footnote, p. 222). A glance at figures 39 and 40 (Plate 4) of this paper will also show a variability in shape of the eleven bivalent chromosomes. In my account of tetrad *A*, I have shown that this element may or may not form rings, so that this character could not be used as a criterion for identification in the earlier postspireme stages. But in spite of these exceptions, there does exist in many cases a strong tendency for a chromosome to assume the same shape at similar stages in all the cells of an animal, and the exceptions have no significance in relation to the question of a variation in the fundamental organization of the tetrads.

In the case of unequal tetrads, however, variation in shape does have some meaning with reference to chromosomal organization. In the specimens of Phrynotettix which I have studied, the shape of tetrad *B* in two individuals is fundamentally different from that in the other eleven, because, in the latter, a definite part of one member of the pair is lacking. Similarly, in the case of C_1 and C_2, the difference concerns a definite part of the members of the pairs. But the important thing to be kept in mind is that the organization of each of these tetrads is constant for any individual animal, and such differences as exist between individuals can be readily accounted for.

b. Persistent Organization of Chromosomes.

1. *The selected chromosomes.*— One of the most important conclusions arrived at in the present study relates to the constancy in the finer organization of the chromosomes, both from stage to stage in the same individual, and from one individual to another. This is shown in two ways: — first, by the existence in chromosome-pair *B* of an architecture that is constant both for any one individual in the various stages in which any architectural condition could be recognized, and likewise for all the individuals studied; secondly, by that of a particular pair of chromosomes (*A*) recognizable through all the stages from spermatogonia to spermatids, the recognition being made possible by the fact that the chromosomes in question possess properties which are characteristic and constant for all stages.

Both of these selected chromosomes, *A* and *B*, tend to stain more deeply than the other autosomes, but this tendency is much more marked in *A* than in *B*. If chromosomes possessing similar peculiarities be found in related species, may they not be regarded as homologous to the selected chromosomes *A* and *B* of Phrynotettix? I think such homologies could be established. Miss Carothers ('13) shows that the small unequal tetrad in Brachystola is usually associated with the accessory chromosome, and is more intensely stained than the other autosomes. Might it not be possible to analyse this unequal element in Brachystola and determine its relation to the unequal tetrads of Phrynotettix? Since these two genera are closely related, I believe this would be possible. Furthermore, the other unequal tetrads described by Miss Carothers for Arphia and Dissosteira were among the small chromosomes and, on account of the similarity in behavior, might be found homologous to *B* or *C* of Phrynotettix.

Miss Nowlin ('08) describes for *Melanoplus bivittatus* a precocious tetrad (no. 11), which always appears in the metaphase as a rod extended parallel to the spindle-axis. Such is also the behavior and form of chromosome *A*. Furthermore, I have examined slides of Melanoplus material and find that it also has a spireme loop that stains more deeply than the others. May not this precocious tetrad of Melanoplus be related to chromosome *A* of Phrynotettix?

Early in the course of my investigation I had the opportunity of looking over some of Dr. McClung's collection of slides of acridian material, and, though a thorough study was not made, I could easily recognize in the pachytene stage of a number of species a spireme loop which stained more deeply than the others. Such loops were found, for example, in species of Aeoloplus, Amphitornis, Arphia, Brachystola, Hadrotettix, Hesperotettix, Hippiscus, Melanoplus, Phaetaliotes, and Stenobothrus. One characteristic of such threads, which, however, is not so marked in Phrynotettix, is a tendency to become associated with the accessory chromosome. This is particularly true of Melanoplus and Stenobothrus, the forms in which Davis ('08) was led by this close association to describe a "double monosome." There can be no question, I think, that these "double monosomes" were merely the accessory chromosome plus one of these deeply stained spireme segments. In view of these facts, the suggestion offers itself, that similarity in the properties and behavior of certain chromosomes in different species may be correlated with their taxonomic relationships. Such correlation was, indeed, seen and discussed some time ago by McClung ('08a). Meek ('12) has already made a comparative study of the sizes of the chromosomes in several species of Stenobothrus, and has reached the conclusion that the five smaller pairs of chromosomes are of the same size in all species, but that the large (V-shaped) pairs differ from one species to another. It still remains to be seen whether or not the chromosomes of different species can be compared on the basis of their details of organization and behavior, as well as size.

2. *The heterochromosomes.*— I believe most observers agree that the heterochromosomes maintain their individuality through the growth-stages of the male germ-cell cycle. On another page (p. 87) I have called attention to the similarity in behavior between the autosomes and the accessory, this has also been noted by many others, so that there is no very good ground for setting up a claim to fundamental distinction between the two kinds. It seems to me, therefore, that if we admit a persistent individuality for the heterochromosomes,

we must at the same time admit a high degree of individuality for the autosomes.

3. *Plasmosomes and nucleoli.*— One of the most puzzling problems that cytologists have to deal with is the behavior and function of the so-called 'plasmosomes' or 'nucleoli.' They apparently exhibit such a variety of reactions to methods of technique, and exhibit such varying relationships to other structures in the cell, that it is almost hopeless even to attempt to classify them. That they play some important rôle in the physiology of the cell, there is not the slightest doubt, but what that rôle is, or what relation they bear to the question of chromosome-individuality, are problems that are far from a solution at the present time.

In my description of the tetrads *A* and *B*, I called attention to a peculiar modification of one of the terminal granules of each. I emphasized the fact that, in the case of tetrad *A*, this modified granule furnished a means of identification for this element. Just what the nature of this modification is, I cannot state definitely, but in the pachytene stage it has the appearance of an expansion of a previously condensed granule, and I have so treated it in my description. The similar condition in *B* appears to arise in the same way, but in this case there seems to be a more definite boundary to the modified granule, which thus resembles the plasmosomes, or "vesicles," described by Carothers (**'13**). The expanded granule of *A* is usually not homogeneous, some areas within it appearing more dense than others. This condition probably foreshadows that seen in the postspireme stages, where it appears more like a collection of small granules, typically three in number. Miss Carothers described the 'vesicles' that she found as being attached to spireme threads, and in some cases to specific threads. Furthermore, she found that the occurrence of the vesicles extended to several species, and, in some species, through several generations of cells. I am indebted to Dr. McClung and to Miss Carothers for the privilege of looking over some of the material studied by the latter, as well as for the opportunity of studying slides of other species; I can confirm Miss Carothers's observations, and can add that these so-called 'vesicles' are present in nearly every species of grasshopper that I have studied with this object in view.

I believe that the modified granules in Phrynotettix can be homologised with the 'plasmosomes' of other species. I would especially call attention to the fact that these structures are always attached to chromosomes, and that, in Phrynotettix, at least, they always involve a certain part of the chromosome to which they are attached. I believe we may therefore regard them as being related to the organization of the chromosomes, just as much as the polar granules are. A glance at the literature will show how constantly these structures are found; but no one, except Miss Carothers, so far as I am aware, has suggested that they are always attached to some definite region of a chromosome. It would seem to be worth while for some one to make a study of these structures from this point of view.

The changes in staining capacity which the plasmosomes undergo at different stages raises an interesting question as to what may be their relation to the chromatin of the thread with which they are associated. Do they take up chromatin from the chromatin-thread, thus increasing their own stainability, and give it back again as they lose their power to hold the stain? Do they elaborate chromatin from raw materials in the surrounding cell substance and give it up to the chromatin-thread? Is their chromatic substance different from other chromatin? Or, do they have some other way of becoming for a time chromatic and later non-chromatic? May it not be possible to answer some of these questions by carefully resolving into its chromomeres the chromatin-thread with which they are associated, and comparing the constitution at different stages? I believe this could be done on favorable material. In Phrynotettix, these structures are definitely related to polar granules. Are the polar granules to be classed in the same category as the plasmosomes? Is it possible for a polar granule to become transformed into a plasmosome, and then back into a polar granule again? The last question seems to be answered in the affirmative by the conditions in Phrynotettix. In the case of *B*, for example, one of the proximal granules becomes "expanded" in only about 16% of the cases counted. In becoming expanded it has become like a plasmosome. When it is not expanded, it remains a polar granule. Is it any wonder, then, that the plasmosomes have been called 'variable' and 'uncertain' elements of the nucleus?

Plasmosomes are associated with heterochromosomes, as well as with autosomes. Davis ('08), for example, noticed one on the monosome of Stenobothrus, and I have confirmed the observation from slides of my own. Morse ('09) found in cockroaches a plasmosome constantly associated with the "chromatin nucleolus" (accessory), and in addition another body in the cytoplasm, which he called a plasmosome. A similar cytoplasmic body, which stains like chromatin, is found in a number of Acrididae. Dederer ('07) found a plasmosome associated with the pair of idiochromosomes in Philosamia, and

Blackman ('05) found a plasmosome attached to the accessory chromosome of Scolopendra. A long list might be added to show that plasmosomes have been found associated with particular chromosomes. Many attempts, not altogether successful, have been made to explain the baffling relations to the other cell-structures of such bodies as have been called plasmosomes, nucleoli, chromoplasts, karyospheres, etc., but any future attempts to elucidate these relations must, I believe, be accompanied by a recognition of the relations that these structures bear to the organization of individual chromosomes.

4. *Persistence of chromosomes between mitoses.* It still remains to discuss what may be the nature of the "organization" of the chromosomes in the stages through which the nuclear substance passes from one metakinesis to the next. I shall consider briefly (1) the origin of the nucleus from the chromosomes, and (2) theories of continuity.

(1) *Origin of the nucleus.* In my description of the spermatogonial divisions of Phrynotettix (p. 87–91), I pointed out that each chromosome becomes surrounded, as early as the anaphase, by a hyaline region, that this region expands in the telophase; that the chromatin of each chromosome becomes diffused to a certain extent within its own region; that a membrane becomes formed at the boundary between the hyaline region and the cytoplasm, producing the chromosomic "vesicle"; and that the nuclear membrane consists of the outer walls of the vesicles at the periphery of the nuclear group. I drew the conclusion that the hyaline region was formed at the expense of the cytoplasm and that the material of each chromosome tended to remain within the space of its own vesicle, a core of chromatin being particularly noticeable in the center of this region, and that the prophase chromosome subsequently formed was developed out of the substance of one, and only one, of the previously existing telophase chromosomes. Sutton ('00) was the first to describe the vesicles of the spermatogonia of a grasshopper. Since then, Otte ('07) has seen similar structures in Locusta, and Davis ('08) in several Acrididae; Pinney ('08) has described them for Phrynotettix. Sutton stated that in the earlier stages of nuclear formation, each chromosome produced a separate vesicle, just as I have found for Phrynotettix, but that in later stages, the proximal ends fused together, giving a common nuclear cavity, from which the distal ends of the vesicles, particularly the longer ones, projected out like the fingers of a glove. Sutton interpreted these conditions as lending strong support to the theory of individuality. Otte believed that the individual vesicles remain distinct throughout the whole of the interkinetic phases, and

Pinney reached a similar conclusion. Davis, on the other hand, could recognize only an irregular outline for the nucleus, and did not identify the vesicle of even the monosome with certainty. Gerard (**'09**) saw the hyaline regions about the telophase chromosomes of Stenobothrus, and stated that the nuclear membrane was formed in connection with them. Since similar conditions have been reported by so many observers, it would seem that these vesicular structures are the result of normal processes and not, as claimed by Vejdovský (**'11–12**), artifacts.

If we turn to accounts other than those on orthopteran spermatogenesis, we find that the formation of chromosomic vesicles out of individual chromosomes in the telophase is by no means of rare occurrence. Van Beneden (**'83**) noted in his work on Ascaris that each of the two chromosomes of the female pronucleus often formed a separate 'half-nucleus.' Häcker (**'95b**) observed that the chromosomes of the early cleavages of *Cyclops brevicornis* formed two groups of "Bläschen," one group from the maternal and another from the paternal pronuclei. Conklin (**'02**) calls attention to the occurrence of such chromosomic vesicles, and gives the history of the nuclear changes during the cycle of division in Crepidula as follows (p. 45): — "(1) The chromosomes, consisting of chromatin enclosed in a linin sheath, divide and move to the poles of the spindle, where they partially surround the spheres. (2) Here they become vesicular, the interior of the vesicle becoming achromatic, though frequently containing a nucleolus-like body, while the wall remains chromatic. (3) These vesicles continue to enlarge and then unite into the "resting nucleus." The nuclear membrane is composed of the outermost walls of the vesicles, while the inner walls stretch through the nucleus as achromatic partitions. The chromosomal vesicles for the egg and sperm nuclei remain distinct longer than those from the same nucleus .... Such vesicles are found generally, if not universally, in the early division of ova, though they are not usually found in other mitoses." Smallwood (**'05**) describes similar chromosomic vesicles in the eggs of nudibranchs. He found that during the "rest-pause" between the first and second maturation divisions the chromosomes frequently have distinct vesicles. There may be a single vesicle for all the chromosomes, or a single vesicle for each chromosome; all conditions between these two extremes occur. Medes (**'05**) in her work on Scutigera found in the second spermatocytes (p. 174) that: — "There is no immediate formation of a nuclear membrane, but each separate chromosome, as it disintegrates, becomes enclosed in a membrane of its own, thus forming a structure similar to a nucleus but containing only a single chromosome." Kornhauser (**'15**, p. 408) says concerning the spermatogonia of Hersilia: — "The telophase chromosomes become gradually fainter in outline, and a clear area in the cytoplasm begins to form about them. It is, I believe, the boundary between this clear area and the more reticular cytoplasm which forms the new nuclear membrane." Thus it will be seen that it is quite usual for telophase chromosomes to form individual nuclei, which later fuse to form the whole nucleus, and with Smallwood (**'05**) we may accept this tendency as an argument for chromosomal individuality.

(2) *Theories of continuity.* Among those who support a theory of continuity, there is not always agreement as to what structures are carried from one cell-generation to the next. It is generally agreed that the chromosomes are composed of at least two substances; the chromatin and the ground substance (linin, plastin). Häcker (**'04**) formulated the "Successionshypothese," stating that the persisting structures of the chromosomes consisted of the "Grundsubstanz," or achromatic part. Bonnevie (**'08a**) and others, on the contrary, regard the chromatic substance as the persistent portion and the achromatin as the temporary part of the chromosome.

Vejdovský (**'07**, **'11–12**) has evolved a most elaborate theory touching this problem. In his monograph of 1907, he based his conclusions on a study of the ovogenesis and maturation of some annelids. He concludes that the nucleus is derived from the chromosomes and from them alone. He divides the interkinetic stages into two periods; the one during which the nucleus is formed out of the chromosomes he calls "katachromasis," and the one during which the chromosomes are formed out of the nucleus he calls "anachromasis." In his later monograph (**'11–12**) he analyses these processes still further and attempts to describe in detail the events in the two periods. His conclusions may be briefly stated as follows: — A chromosome is composed of two substances, one a less deeply staining substratum, on the surface of which is the other, the more deeply stainable chromatin. In the early stages of katachromasis, the chromatin differentiates into a spiral thread, or "chromonema," which is coiled about the surface of the substratum. The substratum then dissolves, forming the nuclear sap, or "enchylema." The chromonema further differentiates into a finely coiled chromatic portion, inside of which is a linin core. In this condition, he recognizes the anlage of the chromosome of the succeeding generation. The linin substance of the chromonema is to become the substratum of the future chromosome, and the finely coiled chromatic portion will become its chromonema. In successive generations, therefore, there is a changing composition of the chromosomes. During each katachromasis, the ground substance of the chromosome dissolves, leaving the chromonema, which becomes differentiated into the two kinds of substance found in the chromosome of the next generation. This is an ingenious theory, to say the least, and carries with it some measure of support for the theory of individuality, inasmuch as each new chromosome is formed out of the substance of a preceding one.

I have found nothing in my studies to support any one of these theories to the exclusion of the others. It is rather surprising, however, that Vejdovský found no indication of the chromosomic vesicles in the spermatogonia of the Orthoptera that he studied and that he regards those seen by others as artifacts. I find little evidence of a chromonema in the telophase of the spermatogonia, and what evidence there is would indicate that the chromatin becomes distributed on the *inner* surface of the vesicular walls, not on the outer surface of an achromatic core. In the telophase of the last spermatogonia, I find a spiral thread forming, but it develops out of the chromatin at the middle of the area occupied by a vesicle. But whether we accept any one of these theories, or reject all of them, there still remain the strongest grounds for believing, as they all indicate, that there is some underlying organization which is in some way perpetuated for each individual chromosome. I am inclined to the belief that this organization involves both chromatic and achromatic substance.

In plant material evidence which indicates a continuity of the chromosomes has not been wanting. Grégoire (**'07**, **'10**) believes that the results of his own investigations and those of others on plants furnish strong support for the individuality theory. Stout (**'12**) has recently added evidence for this belief in his work on *Carex aquatilis.* He says (**'12**, p. 36): — "The chromosomes are present in all resting nuclei as visible units of a definite number. These individual chromosomes can be traced as such through all stages of both somatic and germ-cell divisions, with the exception of the various stages of synapsis (synizesis)." Lee (**'13**) also finds continuity of the chromosomes in plants through the "rest-stage." He believes that the chromosomes of even the metaphase become vacuolated, that this vacuolization increases in the telophase, where, later, a spiral thread is formed out of each chromosome. This spiral thread becomes the prophase chromosome of the succeeding division. He introduces the term "spirophase" to designate the so-called "rest-stage."

There seems to be a great amount of disagreement as to just what constitutes individuality, but I believe that we may class as instances of individuality all cases where it can be shown that the substance of any telophase chromosome gives rise to one and only one prophase chromosome. In that event, any one of the three theories mentioned above would support the theory of individuality. I believe that I have demonstrated individuality for chromosome-pair *A*, and have shown good evidence for it among the other chromosomes of Phrynotettix. Besides, it seems to me much more logical to regard the constant reappearance of the same architectural conditions of a given chromosome as a result of continuity of that architecture in some form or other through all the cell-divisions, than to assume that the organization is entirely destroyed and reestablished between successive mitoses.

C. Chromosomes and Heredity.

Any discussion of the relation of the chromosomes to heredity must deal to a considerable extent with theory and speculation. Yet there are many facts which tend to the belief that the chromosomes are, after all, directly concerned with the transmission of hereditary qualities. A few facts and some theory will be considered in the following paragraphs under the two heads: — (a) Mendelism and maturation, and (b) some experimental evidence.

a. Mendelism and Maturation.

Wilhelm Roux was apparently the first to formulate, in the early eighties, a theory in which an attempt was made to localize the carriers of hereditary qualities in the chromosomes; this was later elaborated by others, especially by Weismann, who postulated a reduction division which has since been identified with one or the other of the maturation divisions. Montgomery ('01) pointed out that the chromosomes of the diploid series occur in pairs, the members of each pair being of the same shape and size. There are thus two similar series of chromosomes. He concluded that one series was derived from the maternal, the other from the paternal ancestor. He concluded further that the members of each pair unite to form the bivalent chromosomes of the first spermatocytes. Boveri ('02) decided from the results of his experiments on dispermic echinoderm eggs, that the chromosomes were qualitatively different. Sutton ('**03**) in the following year, explained how the behavior of the chromosomes in maturation could be correlated with the behavior of Mendelian characters. He showed: — (1) that the union of chromosomes of diverse origin into pairs and their subsequent separation in one of the maturation divisions would insure to every gamete one of every kind of chromosome in the series: (2) that if the law of chance were operative in the orientation of the pairs on the maturation spindles, every possible combination of male and female chromosome could result; and (3) that such a recombination according to the law of chance would account for the transmission of Mendelian characters, if the chromosomes retained their individuality and really were the carriers of the qualities.

This work of Sutton has been generally accepted as proving the correlation assumed, but it remained for Carothers ('**13**) to demonstrate that the law of chance actually does operate in the distribution of the chromosomes in the maturation spindles. In the case of the unequal tetrads described by her, it was shown that either the large or small member of the pair may go to the same pole as the accessory chromosome, which, as usual, was found to go to one pole undivided. Moreover, it was found that the ratio between the two results of distribution was approximately one to one. Robertson ('**15**) has very recently published some of his work on the Tettigidae, where he has found the same rule to hold for the unequal pairs that were present in his material. The behavior of tetrad C_1 in Phrynotettix agrees with that described by Carothers and Robertson. These cases establish the fact that there really is a distribution of chromosomes in the maturation divisions according to the law of chance.

A further consideration of the cases of unequal tetrads in Orthoptera will show in how far the theoretical possibilities as to chance distribution have been realized. Baumgartner ('**11**) in reporting his results on *Gryllotalpa borealis* before the American Society of Zoölogists, stated that he found in the first maturation mitosis an unequal pair of chromosomes, of which the larger dyad always went to the same pole as the accessory. Payne ('**12**) found the same conditions in this species of Gryllotalpa. He regards the large member as possibly associated with the accessory to form a sex-group, similar to the groups in Conorhinus and Fitchia (Payne, '**09**), or in Thyanta (Wilson, '**10**), with the exception that in Gryllotalpa the grouping occurs in the first spermatocyte metaphase instead of the second. Payne suggests that the chromosomes instead of following a haphazard method of distribution in the maturation divisions, may always move the same way, *i. e.*, all the chromosomes brought into the egg may pass into the female-producing sperm. It is extremely doubtful if the last suggestion will prove applicable as a general rule, but the conditions in Gryllotalpa are interesting exceptions to what has been found in the Acrididae and Tettigidae.[1]

Hartmann ('13) describes small chromosomes as dividing unequally in some male germ-cells of Schistocerca. In one first-spermatocyte cell he found two such chromosomes (tetrads) dividing unequally, and he found some cases of unequal division in the secondary spermatocytes. These observations, if correct, would lead one to suspect that he might have been dealing with a condition similar to that in Phrynotettix, except that in the first division, either both the small chromosomes divided sometimes reductionally and sometimes equationally, or, while one of them followed this method, the other always divided reductionally.

Bringing together the results of Baumgartner and Payne for Gryllotalpa, those of Carothers for Acrididae, Robertson for Tettigidae, and my own for Phrynotettix, we may arrange a graded series of conditions beginning with (1) tetrad B, in Phrynotettix, which is unequal, but divides equationally in the first division; passing (2) to C_1, which divides with equal frequency either reductionally or equationally in the first division, and when dividing reductionally shows chance distribution with reference to the accessory; thence (3) to the unequal types found by Carothers and Robertson, which always divide reductionally in the first division but show chance distribution, and finally (4) to Gryllotalpa, where division is always unequal in the first spermatocytes, but the larger dyad always accompanies the accessory. Whether this series offers any possible explanation as to the origin of these unequal elements, and their different kinds of behavior, is problematical.

Robertson's work deserves further consideration, because he has found two of the three possible combinations which would be expected out of a random recombination of two unequal elements which conjugate. In the case of Tettigidea, he found the unequal tetrad in only two individuals, all the others showing a pair both members of which were equal to the larger member of the unequal pair. The third possibility, an equal pair, homologous to the smaller of the dyads, was not found. This case is analogous to that of B in Phrynotettix.[1] In Acridium, Robertson found two individuals, one a male, the other a female, possessing an unequal pair of chromosomes, whereas all the other individuals studied showed the homologous pair to be equal, both members being equivalent in size to the smaller of the two members of the unequal pair. This case is analogous to those of tetrads C_1 and C_2 in Phrynotettix, where, also, only two combinations, the same two, out of a possible three have been found.

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[1] Postscript.— Unfortunately I had overlooked the results reported for *Gryllotalpa vulgaris* by Voinov ('14), who found in the first spermatocyte metaphase an unequal pair of dyads, which separate so that sometimes the larger dyad and sometimes the smaller one goes to the same pole as the accessory chromosome. These results are in accord with those mentioned above for the Acrididae and the Tettigidae and it may be surmised that similar conditions perhaps obtain for *Gryllotalpa borealis* but have so far been overlooked.

Robertson calls attention to the obvious possibility of a loss of chromatin from the unequal pair in Tettigidea, and suggests that the loss of Mendelian factors could be accounted for in this way. He also suggests that the loss of the distal ends of both the chromosomes, resulting in a pair of small dyads each equivalent to the smaller member of the unequal pair, might result in lethal conditions, or might mean the loss of factors necessary for development. In the case of the unequal pair in Acridium, he assumes that there has been an addition to one member of the smaller pair. If this element is similar to C_1 of Phrynotettix, as it seems to be, then the simpler explanation would be that a part had been lost, just as in the case of the one in Tettigidea. It is curious that in both C_1 and the unequal pair in Acridium, the same combination, *i. e.*, a pair both members of which would be equal to the larger member of the unequal pair, is lacking. I am inclined to believe, if sufficient material were available, that the remaining possible combinations would be found. The matter could, at least, be tested by experiment. It is the hope of the writer to conduct breeding experiments with this object in view.

One further point remains to be considered in relation to chromosome-pair C. I have described these tetrads in detail elsewhere (p. 85), but a reference to figure 107 (Plate 9) will recall that there are three types, which I have designated as C_1, C_2, and C_3. If similar types exist in the female,— Robertson ('15) found an unequal pair in a female of Acridium,— and random mating be assumed for the animals possessing the three different types, then one ought to obtain in the offspring all possible combinations of the three kinds of chromosomes. Or, if mating involving any two of the types could be made, there should result all possible combinations between them. On account of the small number of animals available for my study, no conclusions as to whether these conditions are realized in nature could be drawn. The presence of the three types in these few animals, however, strongly suggests the possibility of realization, especially since two of the three possible combinations are realized for the two kinds of chromosome in type C_1. The presence of a third type also suggests that there may exist in this case the mechanism for the transmission of triple allelomorphs.

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[1] Since writing this I have had an opportunity to examine slides from some new Phrynotettix material collected during the summer of 1915 by Miss Carothers of the University of Pennsylvania. In some of the individuals of the new material I have found the expected third type of chromosome-pair B composed of two elements both equivalent to the shorter member of the unequal type.

b. Some experimental Evidence.

The most extensive breeding experiments the results of which tend to show that the chromosomes are concerned in the transmission of hereditary characters are those on Drosophila by Prof. T. H. Morgan and his students. In the course of this work they have dealt with over a hundred unit-characters which show Mendelian inheritance, either in a typical or modified form. In Drosophila, there are four pairs of chromosomes, of which one pair is very small, and one is a pair of heterochromosomes, or "sex-chromosomes." In their behavior in inheritance, the hundred and more characters fall into four groups, each group tending to behave as a unit, just as it would be expected to do in case it were carried by a single pair of chromosomes. Of these groups of characters, one is very small, the others much larger, the largest one being the group of "sex-linked" characters. Naturally the small group of characters has been correlated with the small pair of chromosomes and the group of sex-linked characters with the sex-chromosomes.

But there have been exceptions in the case of many pairs of allelomorphs, especially those that are sex-linked, *i. e.*, cases where factors belonging to a certain group have gone into a mating together, but have not always reappeared together, as they would be expected to do if they were all carried by a single chromosome and that chromosome maintained its individuality. These phenomena have been explained by the so-called "cross-over" hypothesis. In this connection Morgan (**'11**) developed what has been termed the "linear arrangement" hypothesis, which was further elaborated by Sturtevant (**'13**). These authors assume that the factors, or "genes," which represent the characters, are distributed in a linear series along the length of the chromosomes. Then, invoking the aid of the "chiasmatype" theory of Jannsens ('09), they attempt to explain the "cross-overs" by assuming, first, that when two chromosomes conjugate side by side, they may become twisted around each other, and, secondly, that the later separation is along a plane, which cuts across the threads once for every complete twist. Considering the matter in relation to the tetrad stages, it might be imagined that the two threads cross each other, and that at the point of crossing, a weakness of the strands causes them to break and then recombine, forming threads each of which is composed of a part of both the original conjugants.

Judging from his figures, Janssens founded his theory on conditions similar to those shown in my figure 38, *a–d* (Plate 3). I am quite sure that the evidence in Phrynotettix does not support the idea that the chromatids break and recombine in any of the postspireme stages. On the contrary, I believe that the chromatids maintain as strict an individuality as I have claimed for the chromosomes themselves. And since these tetrad figures are repeated in so many animals, and even in plants, there would seem to be ground for supposing the behavior to be similar in all.

On the basis of this hypothesis, however, Morgan and his pupils have been able to explain the anomalous behavior of the genes which they call the "cross-over" in a very satisfactory way; furthermore, they have been able to use it in connection with the linear-arrangement hypothesis to predict the behavior of any given character, with reference to any other character in the group to which it belongs, provided its behavior in relation to one or two of the characters of the group is known. But there is one point yet to be noted. I have based my criticism of the chiasmatype theory on the conditions as found in spermatogenesis. One of the peculiar facts found in the work on Drosophila is that there is no "crossing-over" in the male. But why should such a phenomenon occur in the female and not in the male? Is it not possible that in the "great growth" period of the oöcyte,—where the tetrads become so much more expanded and diffused than in the male, even seeming to disappear entirely in some cases,— the tetrads might suffer some such changes as those suggested by the experimental results? There is also to be considered the often repeated condition of parasynapsis in Drosophila, as shown by Metz ('14), which might offer greater opportunities for such "cross-overs" to occur than are found in other animals.

Whatever else may be said of the results of the experiments on

Drosophila, it must be admitted that they go very far towards establishing a direct relationship between the chromosomes and the transmission of Mendelian characters. Perhaps the most convincing evidence of this kind is that obtained by Bridges. He has found that in certain strains involving sex-linked inheritance, some exceptional females appeared which were like their mothers in every respect, and showed no transmission of sex-linked characters from the father, although such transmission would be expected, since the male sex formula is XY and that of the female is XX. Furthermore, he found that such exceptionally produced females inherit directly from their mother the power of producing like exceptions (about 5%). The explanation advanced by Bridges (**'14**) was that "the sex-linked genes were borne by the X-chromosomes and that 10% of the eggs of the exceptional females retained both of the X-chromosomes, or conversely lost both to the polar body." This phenomenon was called "non-disjunction." Breeding experiments showed that an X-chromosome gene could not be the cause of the phenomenon, and the prediction was accordingly made that half the daughters of a non-disjunctional female would be found to contain in addition to the two X-chromosomes a supernumerary chromosome which would be a Y. Cytological investigations have shown that approximately one-half of the daughters of a non-disjunctional female do, in fact, contain a supernumerary Y-chromosome, while the remaining half contain only the two X-chromosomes. I may add that through the kindness of Dr. Bridges, I have been able to examine some of his slides and convince myself of the presence of the extra chromosome. This brilliant piece of work makes it very hard to disagree with Bridges's conclusion (**'14**, p. 109) that, "there can be no doubt that the complete parallelism between the unique behavior of the chromosomes and the behavior of the sex-linked genes and sex in this case means that the sex-linked genes are located in and borne by the sex-chromosomes."

Returning now to a consideration of the linear-arrangement hypothesis, it must be admitted that the theory has attractive possibilities, and up to the present time has stood the test of experimental breeding in Drosophila. It may not be out of place, therefore, to call attention in this connection to the constancy of the granular, or chromomeral organization of the chromosomes of Phrynotettix, particularly in chromosome-pair B. May not this constancy of architecture of the chromosomes have a meaning correlated with that assumed in the linear-arrangement hypothesis? This possibility seems to me to be worthy of further investigation.

D. SUMMARY OF CONCLUSIONS.

It is believed that the present study of the spermatogenesis of *Phrynotettix magnus* has demonstrated: —

1. That conjugation of the chromosome-pairs is by parasynapsis.
2. That the majority of the bivalent chromosomes divide equationally in the first maturation division.
3. That the chromosomes retain their individuality through the spermatogenic cell-generations.
4. That the so-called 'plasmosomes' take their origin from some definite region (granule) of particular chromosomes, but that they may be variable in occurrence and in extent of development.
5. That in the maturation divisions (*e. g.* chromosome-pair C_1) the law of chance is followed in the distribution of the chromosomes.
6. That each chromosome possesses a definite organization, which is expressed in the constancy of the relative sizes and positions of its chromomeres (as seen, *e. g.*, in chromosome-pair B).

In addition, the possibilities are suggested that: — (1) the matter of the behavior of unequal pairs of chromosomes in regard to distribution and recombination may be tested by breeding experiments, (2) the constancy in the arrangement of chromomeres along the length of the chromosome-threads, as described for chromosome-pair B, may have a meaning related to that suggested by Morgan's "linear-arrangement" hypothesis, and (3) that in the varying types of chromosome-pair C there may exist a mechanism for the transmission of multiple allelomorphs.

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EXPLANATION OF PLATES.

The drawings in plates 1 to 9 were in all cases made with the aid of a camera lucida, using a Zeiss No. 12 compens. ocular and a Spencer homogeneous immersion 1.8 mm. objective, N. A. 1.30. Drawings no. 63–65 were made at a magnification of 2,600 diameters, all the others at a magnification of 3,000 diameters. The drawings have been reduced one third in reproduction.

Plate **10** consists of photomicrographs made at a magnification of 1,150 diameters.

Symbols used:

A	designates	selected chromosome-pair "*A.*"
B	"	" " " "*B.*"
C	"	" " " "*C.*"
X	"	accessory chromosome.
G	"	composite granule.
g	"	polar granule.

PLATE 1.

PLATE 1.

All figures are of the *early spermatogonia.*

Figs. 1, 2.— In metaphase.

Figs. 3, 4.— In anaphase. In figure 4 the cytoplasm has been drawn in order to show the hyaline region around the chromosomes.

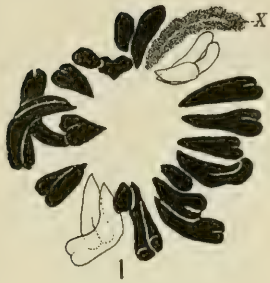
Fig. 5.— Early telophase.

Figs. 6, 7.— Side view and optical section (polar view), respectively, of an early telophase in which the chromosomes have begun to expand. The cytoplasm has been represented in order to show the hyaline region around the chromosomes.

Figs. 8, 9.— Side view and optical section, respectively, of later telophase. Vesicles persistent.

Figs. 10, 11.— Side view and optical section, respectively, of late telophase. Vesicles mostly disappeared.

Figs. 12, 13.— Side view and optical section, respectively, of stage showing the greatest diffusion of chromatin that was found.



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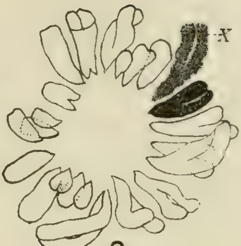

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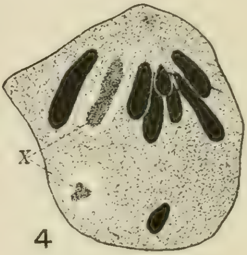

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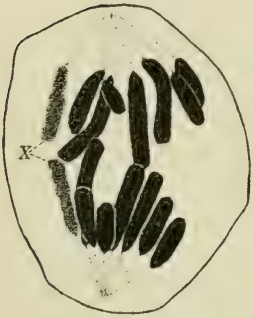

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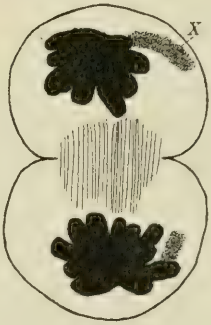

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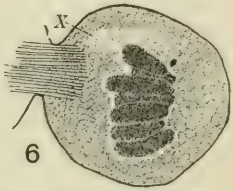

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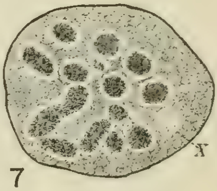

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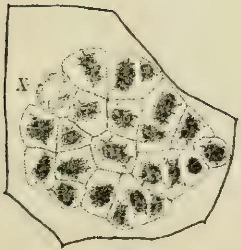

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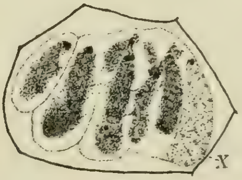

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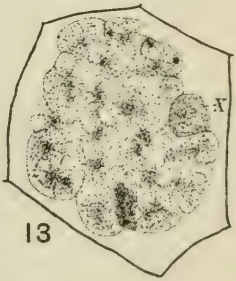

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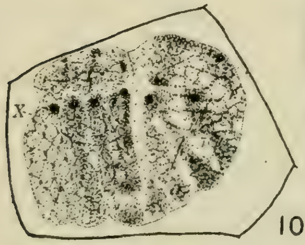

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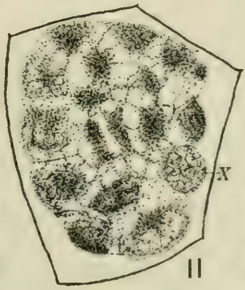

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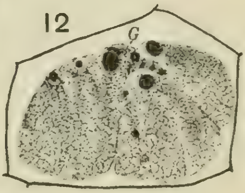

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PLATE 2.

PLATE 2.

Figs. 14–20.— Prophases of early *spermatogonia*.

Figs. 14a, 14b.— Two successive sections of the same cell in earliest prophase.

Figs. 15a, 15b.— Two sections of a single cell in early prophase. Formation of fine spiral thread.

Fig. 16.— Polar view of later prophase. Fine spiral threads, all distinct. Composite granules prominent.

Fig. 17.— Side view of later prophase. Accessory in vesicle. Longitudinal split beginning to appear in threads.

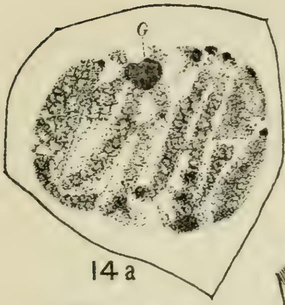
Fig. 18.— Section from distal pole of nucleus. Vesicular walls persisting.

Fig. 19.— Later prophase. Composite granules breaking up into polar granules.

Fig. 20.— Later prophase. Accessory still in vesicle.

Figs. 21, 22.— Side view and optical section, respectively, of telophase of last spermatogonial division.

Figs. 23, 24.— Oblique side view and optical section, respectively, of early preleptotene stage.



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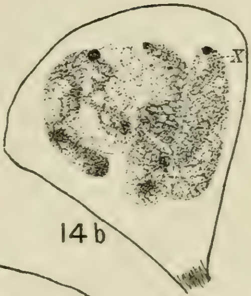

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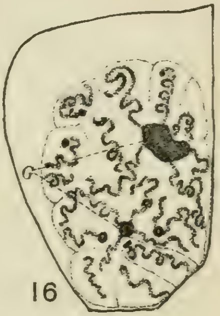

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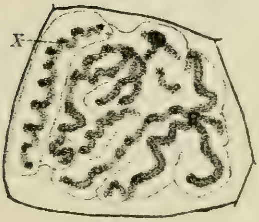

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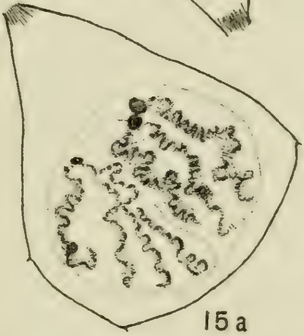

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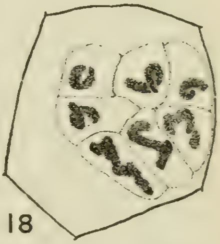

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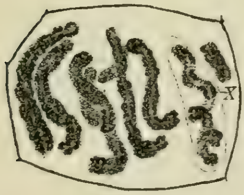

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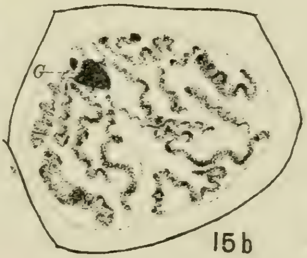

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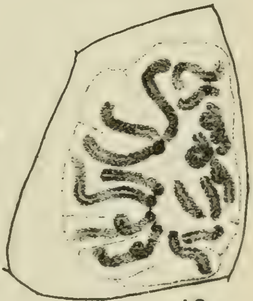

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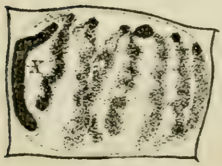

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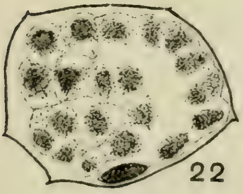

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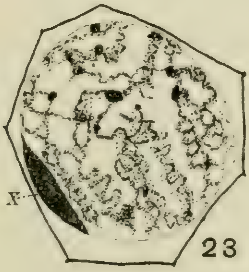

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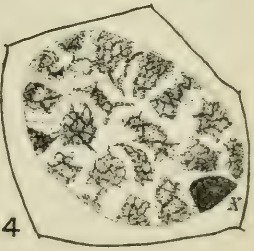

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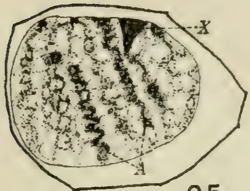
HELIOTYPE CO. BOSTON.

PLATE 3.

PLATE 3.

Figs. 25–27.— Later preleptotene stage.
Fig. 28.— Early leptotene stage.
Fig. 29.— Later leptotene stage.
Fig. 30.— Early zygotene stage.
Fig. 31.— Later zygotene stage.
Figs. 32, 33.— Early pachytene stages.
Fig. 34.— Later pachytene stage.
Figs. 35–37.— Stages of breaking up of composite granule of pachytene stage into its component polar granules.
Fig. 37.— Diplotene stage.
Fig. 38, *a–g*.— Different types of tetrads from a single cyst of postspireme, or tetrad, stage.



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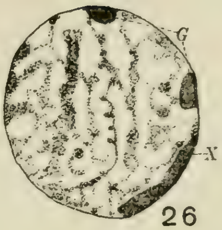

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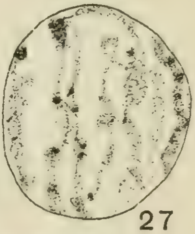

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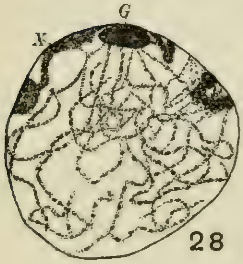

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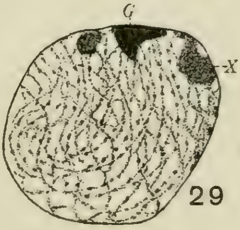

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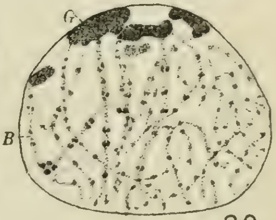

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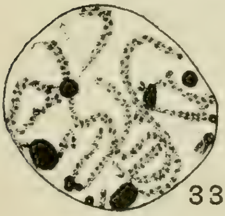

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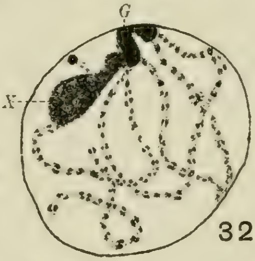

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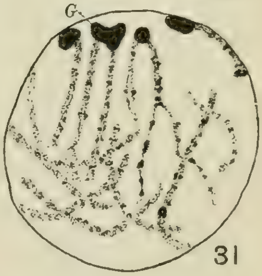

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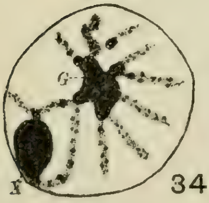

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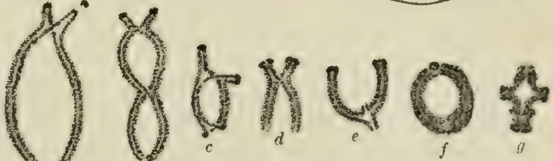

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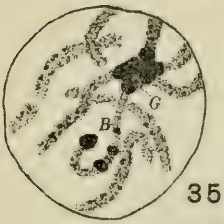

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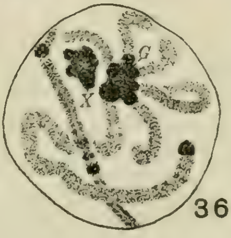

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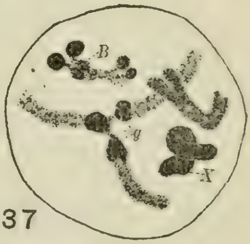

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HELIOTYPE CO. BOSTON.

PLATE 4.

PLATE 4.

Figs. 39–44.— Stages in division of *first spermatocytes.*

Fig. 39.— Polar view of metaphase, showing twelve chromosomes.

Fig. 40.— Polar view of metaphase (eleven chromosomes).

Fig. 41.— Side view of anaphase, showing dyads.

Fig. 42.— Polar view of anaphase, showing twelve dyads.

Fig. 43.— Polar view of anaphase, showing eleven dyads.

Fig. 44.— Telophase.

Figs. 45–49.— *Interkinesis stages.*

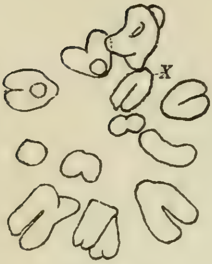
Fig. 45.— Dyads undergoing diffusion.

Fig. 46.— Dyads (except the accessory) still more diffused.

Fig. 47.— Stage of greatest diffusion. Outline of dyads uncertain.

Fig. 48.— A prophase of the second spermatocyte division. Outline of dyads reappearing in the middle of the area in which they diffused.

Fig. 49.— Late prophase of second spermatocyte. Dyads fully reformed.



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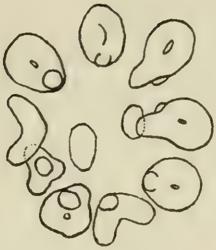

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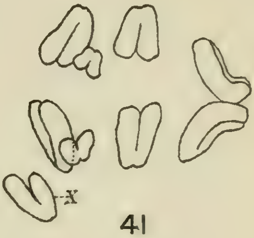

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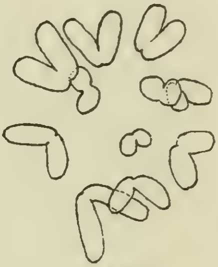

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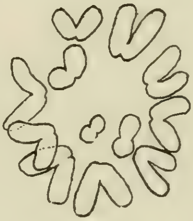

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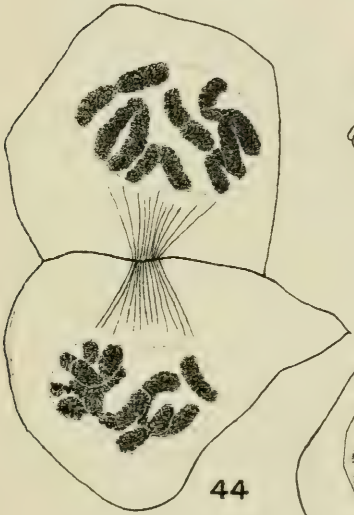

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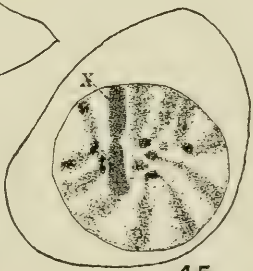

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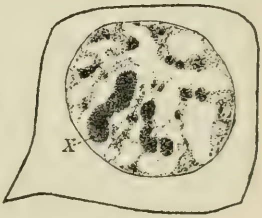

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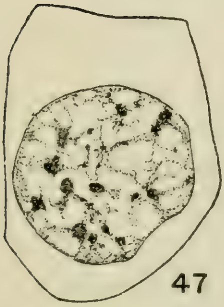

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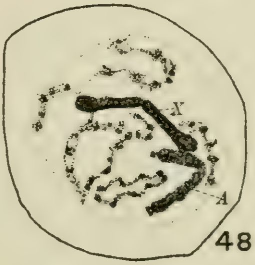

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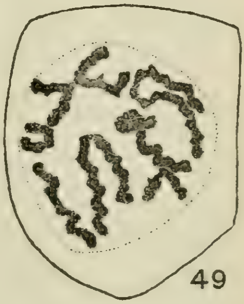

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HELIOTYPE CO. BOSTON.

PLATE 5.

Figs. 50–55.— Stages in division of the *secondary spermatocytes.*

Figs. 50, 51.— Polar views of metaphase, showing eleven and twelve chromosomes, respectively.

Fig. 52.— Side view of metaphase.

Fig. 53.— Side view of early anaphase.

Fig. 54.— Side view of late anaphase.

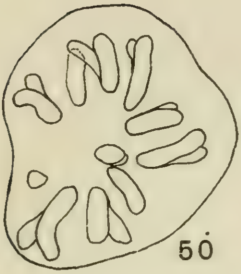
Fig. 55.— Polar view of telophase.

Figs. 56–61.— *Pachytene stages of first spermatocyte.*

Figs. 56, 57 showing spireme loop of selected chromosome-pair "*A*,"

Figs. 58, 59 showing spireme loops of selected chromosome-pair "*B*," and

Figs. 60, 61 showing spireme of selected chromosome-pair "*C*." Figure 61 shows in addition the "*B*" spireme.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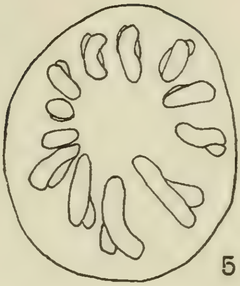
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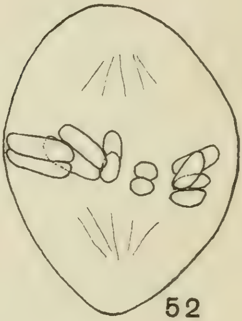
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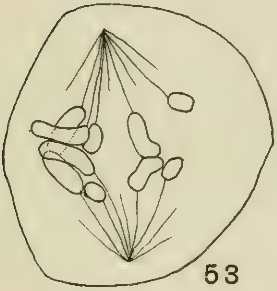
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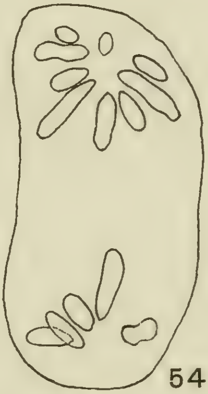
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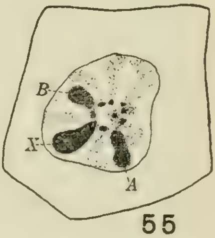

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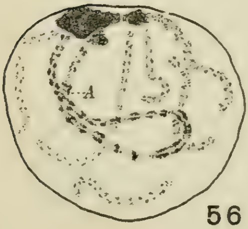

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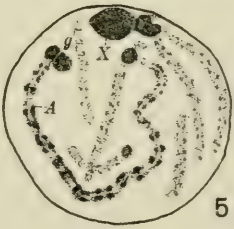

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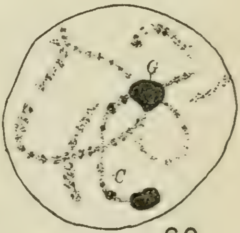

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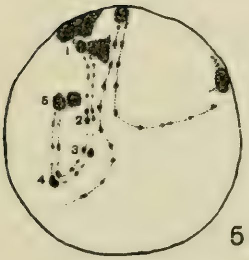

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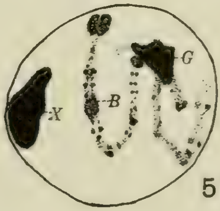

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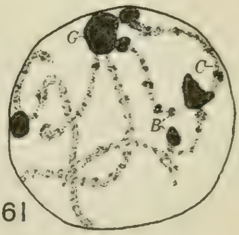

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HELIOTYPE CO. BOSTON.

PLATE 6.

PLATE 6.

Fig. 62.— Stages in the transformation of chromosome-pair "*A*," from pachytene spireme to metaphase of the first spermatocyte.

Fig. 63.— Similar stages for the chromosome-pair "*B*," for the equal-type.

Fig. 64.— Same stages for the pair "*B*," unequal type.

Fig. 65.— Similar transformation stages for chromosome-pair "*C*."

Fig. 66.— Telophase of an early spermatogonium, showing members of chromosome-pair "*A*."

Fig. 67.— Telophase of one of the last spermatogonia, showing members of chromosome-pair "*A*."

Figs. 68, 69.— Preleptotene stages, showing persistence of chromosome-pair "*A*."

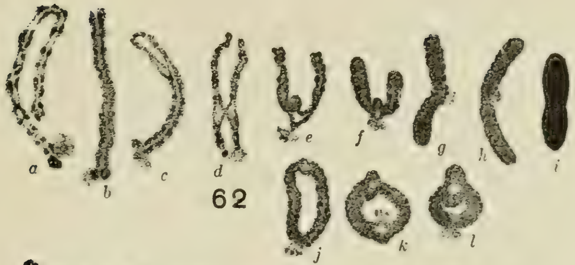
Fig. 70.— Early leptotene. Conjugation of pair "*A*."

Fig. 71.— Later leptotene. Conjugation of pair "*A*." Spireme of the accessory.

Fig. 72.— Spireme of the accessory.

Fig. 73.— Zygotene stage, showing conjugation of pair "*A*."

Fig. 74.— Zygotene stage, showing conjugation of pair "*A*" completed.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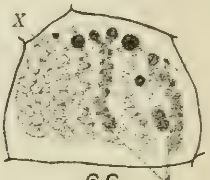

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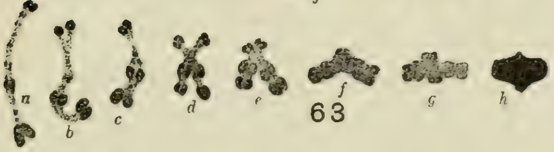

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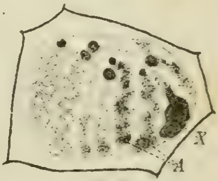

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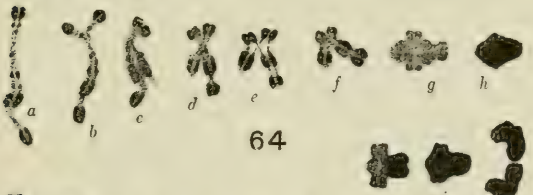
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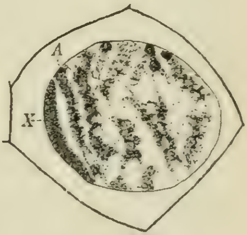

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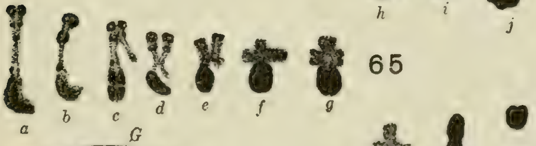
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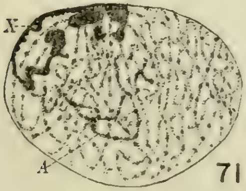

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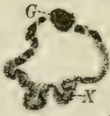

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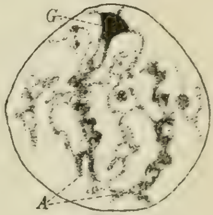

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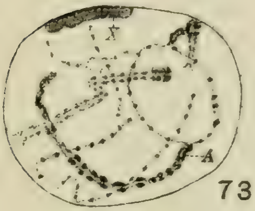

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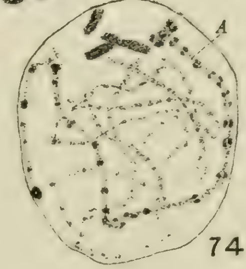

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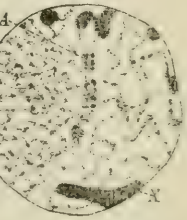

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HELIOTYPE CO. BOSTON.

PLATE 7.

PLATE 7.

Figs. 75–78.— Zygotene stages showing incomplete conjugation of chromosome-pair "*A*."

Fig. 79.— Side view of first spermatocyte metaphase, showing tetrad "*A*," as an extended rod with a constriction in the middle.

Fig. 80.— Polar view of a telophase of the first spermatocyte, showing dyads "*A*" and "*B*."

Fig. 81. Side view of a telophase of the first spermatocyte, showing dyads of "*A*" and the accessory.

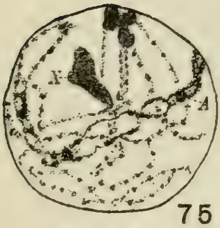
Fig. 82.— Side view of first spermatocyte telophase, showing the "*A*" dyads in both daughter cells.

Fig. 83.— Interkinesis stage, showing the accessory dyad and the "*A*" dyad (more condensed).

Fig. 84.— Interkinesis stage, showing the accessory dyad and the "*A*" dyad (less condensed).

Fig. 85.— Telophase of the second spermatocyte, showing the "*A*," "*B*," and accessory monads.

Fig. 86.— Telophase of the secondary spermatocyte, showing the "*A*" and "*B*" monads.



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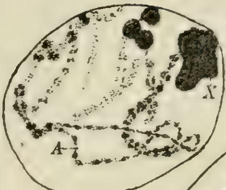

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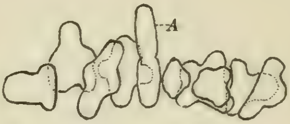

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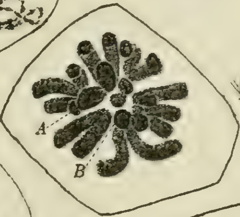

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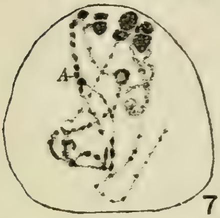

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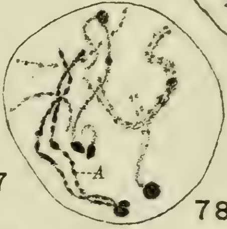

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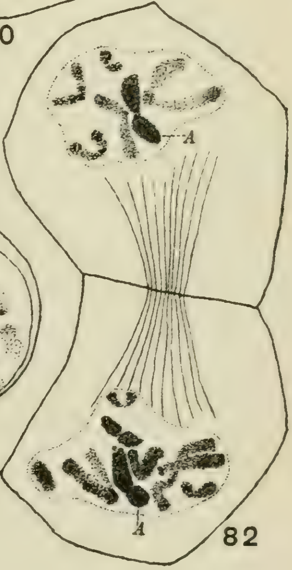

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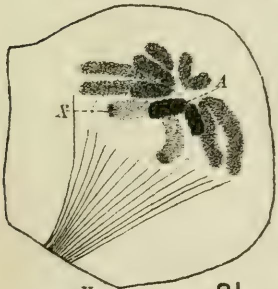

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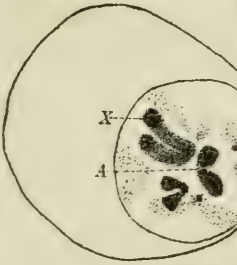

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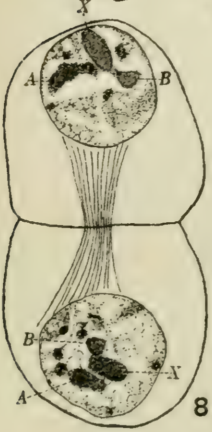

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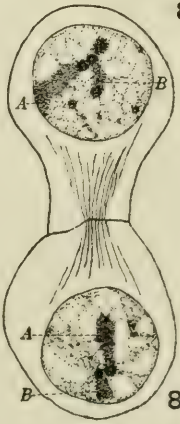

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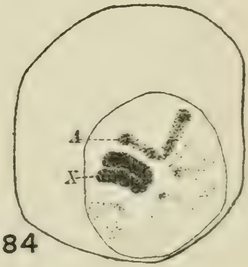

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HELIOTYPE CO. BOSTON.

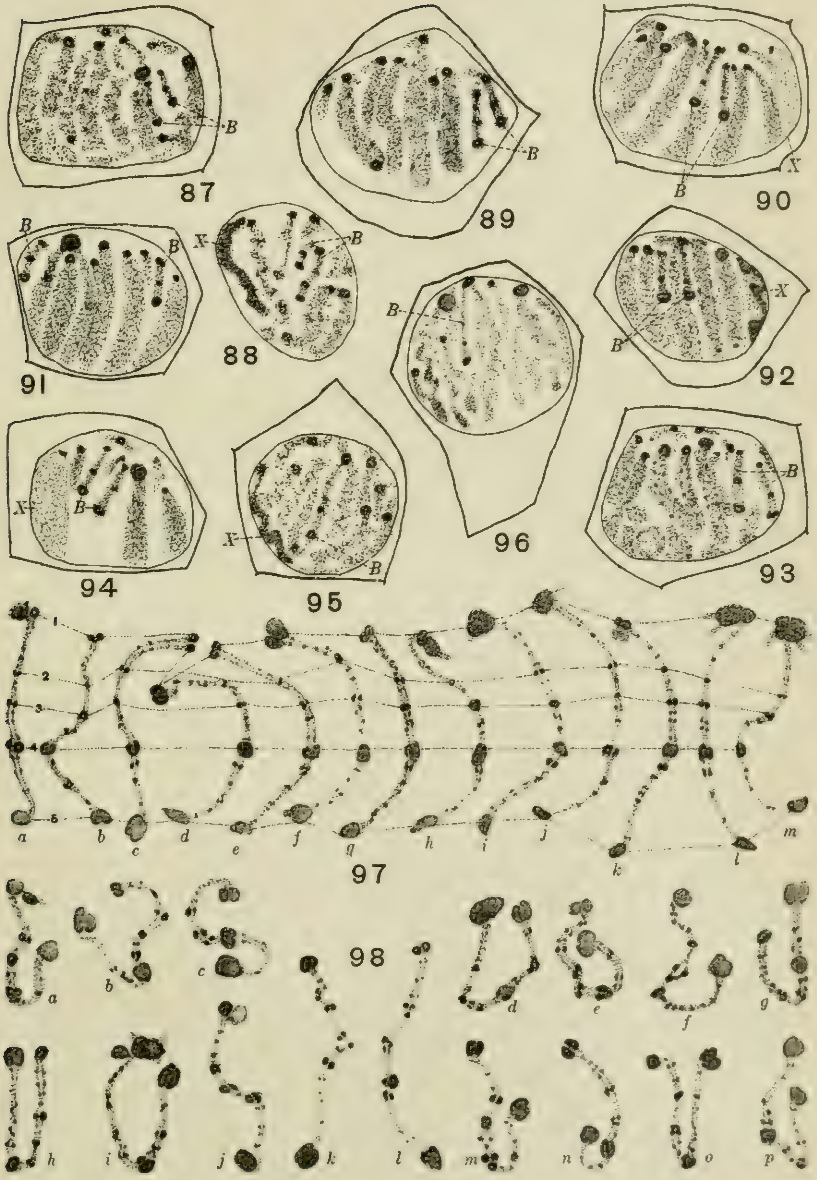
PLATE 8.

PLATE 8.

Figs. 87–96.— Telophases of spermatogonia, showing members of chromosome-pair "*B*" (all from one animal, no. 772).

Fig. 97, *a–m*.— One example of chromosome-pair "*B*," in the pachytene stage from each of the 13 animals studied.

Fig. 98, *a–p*.— Examples of chromosome-pair "*B*" from the pachytene stage of a single animal (no. 772).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HELIOTYPE CO. BOSTON.

PLATE 9.

PLATE 9.

Fig. 99.— Side view of first spermatocyte metaphase, showing roughened condition of the accessory, of chromosome-pair "*B*," and of the polar tips of autosomes.

Fig. 100.— Side view of first spermatocyte metaphase, showing roughened condition of chromosome-pairs "*B*" and "*C*," and of the accessory.

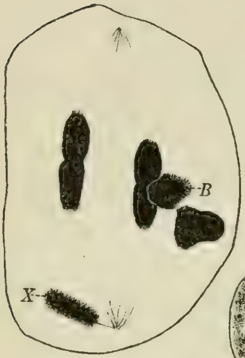
Figs. 101–105.— Telophases of spermatogonia, showing the larger members of the chromosome-pairs "*B*" (unequal type) and "*C*" (type C_1).

Fig. 106.— An example of tetrad "*B*" from each of the 13 animals studied.

Fig. 107.— An example of tetrad "*C*" from each of the 13 animals studied. (The corresponding letters in figures 106 and 107 refer to the same animal).

Figs. 108–110.— Telophases of connective-tissue nuclei, showing polar granules and chromosome "*B*."

Figs. 111, 112.— Nuclei from the follicular envelope.



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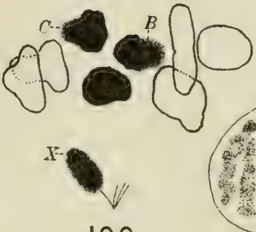

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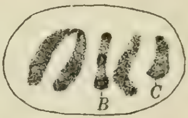

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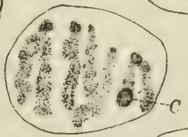

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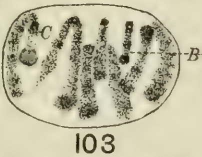

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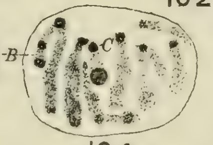

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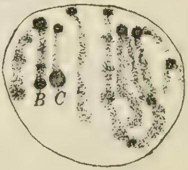

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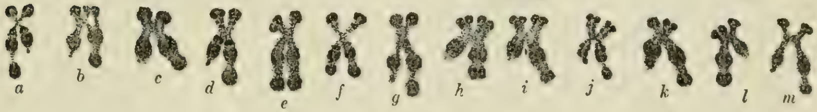
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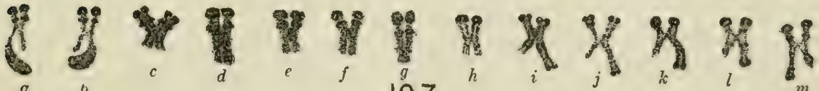
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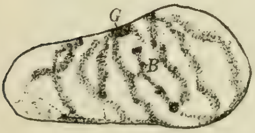

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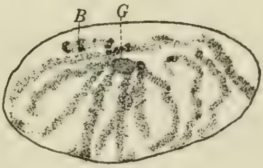

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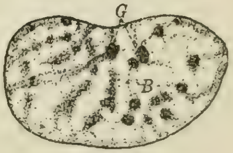

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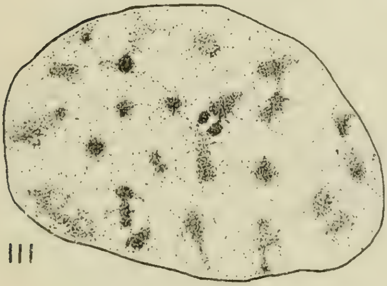

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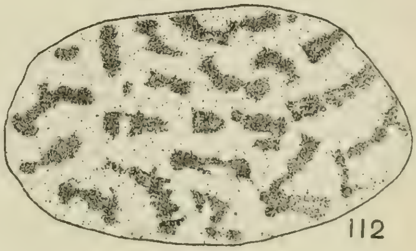

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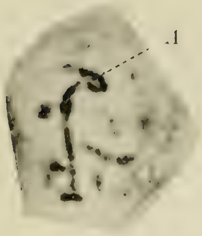
HELIOTYPE CO. BOSTON.

PLATE 10.

PLATE 10.

Photomicrographs.

Fig. 113.— Spireme of "*A*" in the pachytene stage.
Fig. 114.— Tetrad of "*A*."
Fig. 115.— Pachytene spireme loop of "*B*."
Fig. 116.— Tetrad of "*B*."
Fig. 117.— Tetrad of "*C*" (type C_1).
Fig. 118.— Both tetrads, "*B*" and "*C*," dividing equationally in the same spindle.
Fig. 119.— Tetrad "*B*" dividing equationally and tetrad "*C*" dividing reductionally in the same spindle.
Fig. 120.— Unequal division of "*C*." Smaller dyad going to same pole as the accessory.
Fig. 121.— Unequal division of "*C*." Larger dyad going to same pole as the accessory.



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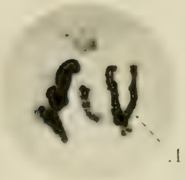

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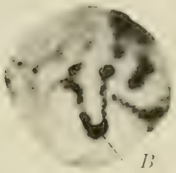

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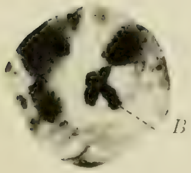

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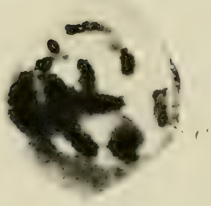

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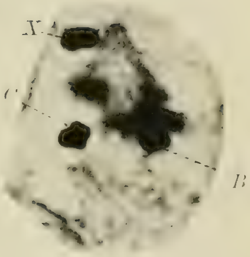

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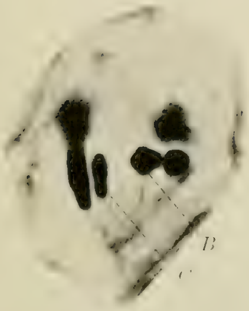

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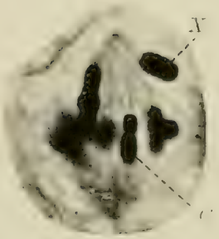

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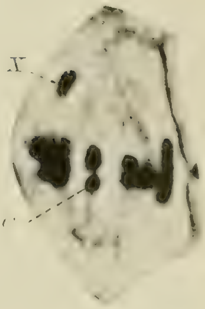

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D. H. W. PHOTO

HELIOTYPE CO., BOSTON.

Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. LX. No. 4.

A REVISION OF THE LIZARDS OF THE GENUS CYCLURA.

By Thomas Barbour and G. K. Noble.

With Fifteen Plates.

CAMBRIDGE, MASS., U. S. A.:
PRINTED FOR THE MUSEUM.
February, 1916.

No. 4.— *A Revision of the Lizards of the Genus Cyclura.*

By Thomas Barbour and G. K. Noble.

INTRODUCTION.

Some years ago while working upon West Indian reptiles the senior author became interested in Cyclura. Every opportunity has been grasped which offered the slightest probability of securing specimens, so that now the Museum of Comparative Zoölogy contains more species of that genus than any other museum. That the series is by no means large, will appear at once. The preparing of this revision would have been difficult but for the friendly interest of Mr. H. W. Fowler of the Academy of Natural Sciences of Philadelphia; the unique type of our *C. nuchalis* is in the Museum of the Academy. We take great pleasure in dedicating *C. stejnegeri* from Mona Island to Dr. Stejneger, through whose kindness a paratype from the small series in the U. S. N. M. has been retained for the M. C. Z. From the Carnegie Museum in Pittsburgh we have specimens of *C. rileyi* and of *C. macleayi*, from the Isle of Pines, presented in return for the identification, by the senior author, of the Carnegie Museum series of West Indian reptiles. These he was allowed to study through the kindness of Prof. L. E. Griffin. A number of Rhinoceros Iguanas have been received from time to time at the New York Zoölogical Park, have died and probably most of them have found a resting place in the American Museum in New York. These cannot now be found; one of the examples, however, now mounted in the Museum of Comparative Zoölogy, a gift of the N. Y. Zoölogical Society, was said to be from Navassa Island and seems to represent the species confined to that island. In general, zoölogical park specimens, while very valuable for anatomical study, are often without locality, although this is sometimes supplied from the fertile imagination of an animal dealer. The fine series of examples of *C. carinata* in the New York Zoölogical Park, was, however, a conspicuous exception, since they were known to have come from Turks Island. Unfortunately this entire, valuable series seems to have been lost sight of, and a careful search at the American Museum of Natural History failed to reveal a single one.

GENERAL CONSIDERATIONS.

The members of the genus Cyclura form a small compact group of species confined to the Greater Antillean district of the West Indian region. Related to the Rock Iguanas (Ctenosaura) of the Central American mainland they are nevertheless well set off from the latter by the possession of the peculiar corneous combs or pectinations on the hind toes. Except for this character common to all the West Indian forms, some of these would appear more closely related to some race of Ctenosaura than to another of the island species. On the whole, it does not seem advisable to recognize the genus Metapoceras for the so-called Rhinoceros Iguanas of Navassa, Haiti, and Mona, since they are obviously but slightly advanced modifications of such a type as the Jamaican Iguana, which is a true, and probably ancestral, Cyclura in every respect. The species in the Cayman Islands is nearly related to the Cuban, and the number of forms known from the Bahamas represent two groups of species, one showing affinities with the Cuban, *Cyclura macleayi*. In the Bahamas, *baeolopha* of Andros Island seems most like *macleayi*, with its neighbor, *inornata*, hardly less similar; while *nuchalis* of Fortune, *rileyi* of Watlings, and *carinata* from Turks Island form another well differentiated group of races. The latter species has head-scales of a simple and scarcely modified, one might, at first sight, say obviously primitive nature. We imagine, however, that this condition has been reached secondarily, the transition back through some of the other species being clearly traceable. So that while the scales of the head of *carinata* are of a very simple and undifferentiated character, it is nevertheless extremely improbable, especially in view of its habitat, that the species can be considered ancestral or anything more than a reversion to the probably, or possibly, primitive condition for Cyclura, and Ctenosaura, or their progenitors. It does not seem wise to lay much stress upon the distribution of the species of Cyclura as a basis for any zoögraphic deduction or surmise. We know but little of the habits of the species, the whole group is fast disappearing and will soon be wholly extinct, and even now we are able to characterize but eleven species, probably a comparatively small part of those in existence even two hundred years ago.

Early writers often mention Iguanas in the West Indies, and of these some referred to the genus Iguana and some to Cyclura; among the latter was Catesby. This authority writing upon the Natural

History of Carolina and the Bahamas, states in 1743, that Iguanas or Guanas were abundant upon many islands throughout the Bahamas, so common in fact that schooners were cargoed with them and that they were carried to Carolina for food. The name Guana is even now used among the "Conchs" of the Bahamas, who still speak a peculiar archaic English. A vague idea of how wide-spread these great lizards were in early colonial times may be gained from the Bahaman place-names. Thus, there is a Great Guana Cay, off the Abaco coast not far from Green Turtle Cay, a settlement which once had some importance. This islet was visited by the senior author in 1904 but no Guanas were found, and none had persisted to within the memory of the elder folk living in the tiny hamlet. There is also a Guana Cay near Little Harbor about half way up the chain of the Berry Islands, and not far from one of the Bahaman Whale Cays, for this also is a common place-name. Then we find another Great Guana Cay in the Exuma chain of Cays. In all of these islands Guanas are now unknown. On Bitter Guana Cay, however, but a few hundred yards from the Great Guana Cay in Exuma, Mr. C. J. Maynard tells us that up to 1915 a few Cycluras were still to be found. He believes that these represent an undescribed race. As to the status of the other Bahaman species:— *baeolopha* is still not uncommon, since its habitat, Andros Island, is very large and contains much unsettled and indeed even unexplored territory. Of *nuchalis* from Fortune Island we know nothing. Stejneger's species, *rileyi,* is confined to two tiny islets in the saline lagoon of Watling's Island; here Riley obtained the types in 1903 and W. W. Worthington procured a few specimens in March, 1909. Our new species, *inornata,* is, or was, found upon a little island called U Cay, in Allen's Harbor, north of Highborn Cay and situated in the Archipelago between Exuma and New Providence. Here in 1892 Maynard found the Iguanas not uncommon. He revisited the islet in 1915, was storm bound there and hence had ample opportunity to cover it very completely. He found but two Iguanas still living upon U Cay. Both of these he shot; one, our type, he secured, the other escaped, wounded. Thus the species *inornata,* which once doubtless existed on several islands about Allen's Harbor, is now beyond doubt extinct. Since these creatures are excellent for food, they are constantly hunted by the native negroes, often with dogs trained for the purpose. These negroes during the course of their sponging and turtling voyages cover the entire Bahaman Archipelago, visiting even the most remote, inaccessible, and infertile cays. There is a constant search for animal food, which unfortunately is by no means abundant or easily obtained by the poor inhabitants of one of Great Britain's most delightful but poverty-stricken colonies. Iguanas are often brought from Andros to market in Nassau, upon New Providence Island. One of the authors has seen the creatures for sale there upon several occasions. We have concluded therefore that a magnificent adult male *bacolopha* in the Academy of Natural Sciences of Philadelphia (Reptile Coll. 8120) probably represents such a specimen, although it is said to have been collected by a Mr. Wilson on New Providence in 1861. Our belief is that the Iguanas disappeared from New Providence long before this date. For the benefit of the herpetologists we should also record that Salt Cay, near Hog Island, opposite the town of Nassau, has been stocked with Iguanas brought from Andros Island. Mr. Chamberlain, the owner of Salt Cay is reported to have stated that they have thriven and appear to have become well established in their new home.

Of some of the other species of the genus we know even less than of these we have referred to. *Cyclura collei* has almost certainly completely disappeared upon the mainland of Jamaica and it was only by the greatest stroke of good fortune that Mr. Arthur Perrin of Cambridge who kindly volunteered to make a special excursion for the purpose, was able to secure the specimen, which we describe, from Goat Island not far from Old Harbor off southern Jamaica. Dr. A. G. Mayer tells us that an Iguana was secured a few years ago on one of the cays near Montego Bay, and that he believes a few still exist there. Of the species on Navassa, Haiti, and Mona we know practically nothing. Mr. W. M. Mann who spent some months in Haiti, and who made an excellent collection of reptiles there in 1913 was unable to learn anything of Iguanas and secured none. Mr. Halter from the American Museum, visited Santo Domingo in 1915 and could learn nothing of existing Iguanas. Of the Cyclura on Mona Island we know only that Stejneger quotes Bowdish as saying that he got his specimens in 1901, among the rocks.

The journeys which the senior author has made on a number of occasions permit us to speak with more authority regarding Cuba. Gundlach in 1880 wrote "Esta especie vive en varios cayos y en las costas de la isla de Cuba y de la isla de Pinos; pero es hoy una especie rara, aunque antiguamente fuese comun y llevada a los mercados, siendo su carne estimada como excelente manjar." He goes on to say that it usually lives in burrows in the sand dunes or in sandy places about the coasts where it is easily dug out. Now the Cuban Iguana has with increasing civilization become still more rare and restricted in range. C. T. Ramsden, the accomplished naturalist of Guantanamo has found a few specimens on the coast cliffs of the extreme eastern end of the island. Wirt Robinson sent one to the M. C. Z. from Santiago in December, 1903. The only very young Cyclura we have seen was one loaned by Ramsden, and obtained by Oskar Tollin during a trip to Belig, near Cabo Cruz, in the summer of 1914. The species is still abundant on the Cayos near Manzanillo and those off the south coast near Santa Cruz del Sur. It is fairly abundant on the Isle of Pines. In 1915 while Prof. de la Torre and his assistant Sr. V. J. Rodriguez were collecting with W. S. Brooks and T. Barbour in the region of Guane, we learned that Iguanas were still not uncommon in the limestone mountains which encircle the glorious valley of Luis Lazo. Here we got two fine adult specimens, one for the Museo Poey in Havana and one for the M. C. Z. Prof. de la Torre says that Iguanas are also fairly common on the Pan de Guajaibon and he writes us that he has recently seen one near Baracoa. They persist as well on many of the small and remote cayos of the north coast. Curiously enough in spite of what Gundlach says — no one appears to eat Iguanas in Cuba at the present time. Ramsden has also observed this and writes me that he has been told that Cubans believe the Iguana to be very poisonous. When hung up by the tail, they say, a bába or burujo, as they call it, black drivel or vomit, runs from its mouth. This is supposed to be deadly. The black vomit due to blood in the stomach, which marks the final stage of a fatal case of yellow fever, is also called in Cuba burujo, a name also used for the grounds of coffee, and it may be that some imagined similarity between these burujos, coupled with forgetfulness which increased as Iguanas grew rare, has now spread the idea that Iguanas are unfit for food, when once, in Cuba as elsewhere, they were eagerly sought after.

It will be noticed that some old, long standing specific names have been dropped. The reason for this is as follows:— the name *nubila* was based upon a young specimen without locality. The description given by Gray is worthless. The type is mentioned in Boulenger's Catalogue and hence doubtless is still in existence. When it is examined it will probably be possible to determine whether the name supercedes one used here or whether it represents another distinct species. It is impossible to determine this. Cope attached the name *nubila* to a specimen which he said was from Cat Island and was U. S. N. M. 14576; but Stejneger tells us that this number is borne by a specimen of Leiocephalus and that there is now no Cat Island Iguana in the U. S. N. M. and no evidence that there ever was one. Cuvier first used *cyclura* as a specific name for what he called L'Iguane de la Caroline. After what Catesby said we imagine that he had a Bahaman specimen which had been carried to Carolina and had probably been sent to Paris from there. Which Bahaman species he had it is impossible to decide from his meagre descriptions. So unless the type is still in existence and sufficiently well preserved, which is improbable, it will not be possible to more than surmise that Cuvier probably had a specimen of *C. baeolopha*. Stejneger and Barbour have both used the name *Cyclura cyclura* Cuv. for the Cuban Iguana and this might be considered as restricting the name. It is probably better to drop the name altogether until someone studies this old type, and also the type of *nubila* in the British Museum.

KEY TO THE SPECIES.

a^1 Median frontal shield enlarged and tubercular.
b^1 Nasals broadly in contact with the rostral. . . . . *stejnegeri.*
b^2 Nasals separated from the rostral by small scales, or granules.
c^1 Posterior prefrontals separated from the frontal shield by two rows of scales. . . . . *nigerrima.*
c^2 Posterior prefrontals separated from the frontal shield by a single row of narrow scales. . . . . *cornuta.*
a^2 Median frontal shield very slightly enlarged, not tubercular.
b^1 Nuchal section of dorsal crest formed of spines much longer than those of the back section.
c^1 Prefrontal and frontal scales small and irregular. . . . . *carinata.*
c^2 Prefrontal and frontal scales enlarged and definitely arranged.
d^1 Nuchal section of dorsal crest formed of 14 spines, some twice as wide as the others. . . . . *nuchalis.*
d^2 Nuchal section of dorsal crest formed of 20 spines, all of about the same width. . . . . *rileyi.*
b^2 Nuchal section of dorsal crest formed of spines not distinctly larger than those of the back section
c^1 Scales covering the upper surface of the head flat, depressed, the interstices forming a network; dorsal crest continuous on the shoulders. . . . . *collei.*
c^2 Scales covering the upper surface of the head, especially the snout, swollen; dorsal crest interrupted on the shoulders.
d^1 Infralabials separated from the molar scales by a single discontinuous row of scales; canthal scale very much larger than the precanthal.
e^1 A single, large, flat median frontal; gular region the same color as ventral surface. . . . . *baelopha.*

- e^2 Two large flat median frontals; gular region white in strong contrast to rest of ventral surface. . . . . *inornata.*

d^2 Infralabials separated from the malar scales by several rows of small scales; canthal scale about the same size as the precanthal.

- e^1 Enlarged frontal shield separated from the posterior prefrontals by two rows of scales; 37 spines in the back section of dorsal crest. . . . . *macleayi.*
- e^2 Enlarged frontal shield separated from the posterior prefrontals by five rows of small scales; 44 spines in the back section of dorsal crest. . . . . *caymanensis.*

DISCUSSION OF THE SPECIES.

CYCLURA MACLEAYI Gray.

Plate **1**, **2**; Plate **13**, fig. 5, 6.

Gray Cat. lizards, British mus., 1845, p. 190.

Diagnosis:— Nasals broadly in contact with the rostral. Prefrontal region covered by a pair of elongate supranasals, immediately followed by two pair of large prefrontals, the posterior pair several times as large as the anterior pair; both pairs of prefrontals broadly in contact on the median line of the snout, all these scutes covering the snout slightly swollen and convex. Frontal region between prefrontals and the scarcely indicated supraocular semicircles covered by two irregular rows of scales, the anterior row formed of scales several times as large as those in the posterior one, immediately following the posterior row a large rounded median scale. Supraorbital semicircles scarcely differentiated from the supraocular disc, separated by two, partly by three, rows of scales. Occipital region covered with enlarged and swollen scales, about two rows of scales between the occipital and the semicircles. Canthus rostralis consisting of three large scales, the posterior one elongate and in contact with two supraciliaries which are also elongate,— all these scales on the top of the head swollen, slightly keeled, and, with the exception of the small supraocular scales, uniformly enlarged. Dorsal crest low, the largest spine scarcely over a centimeter high, interrupted on the shoulders and rump, 37 spines between these two points. Color above, brownish gray sprinkled with pale, yellowish green, the spots very abundant and partly confluent posteriorly; flanks marked by four broad, vertical stripes of pale bluish gray, each stripe edged with dark slaty gray; sides and upper surface of the head broadly blotched with pale, bluish yellow.

Habitat:— Cuba, the Isle of Pines, and the neighboring Cays.

Description:— Adult male, M. C. Z., 11050 from the Valley of Luis Lazo, western Cuba, April 1915, C. de la Torre and T. Barbour.

Rostral as wide as the mental, broadly in contact with nasals; nasal large, somewhat pentagonal, perforated by a large, ovoid nostril; each nasal in contact with a large, elongate supranasal and a squarish postnasal; nasals and supranasals broadly in contact in the middle of the snout; the pair of supranasals immediately followed by two pair of large prefrontals, the posterior pair several times as large as the anterior pair, both pairs of prefrontals broadly in contact in the middle line of the snout; a few granules on the crossing point of the two prefrontal sutures; all these scutes covering the upper surface of the snout slightly swollen and convex; between prefrontals and the scarcely indicated supraocular semicircular two irregular rows of scales, the anterior row formed of scales several times as large as those in the posterior one; immediately following the posterior row a large rounded median scale; supraorbital semicircle differentiated from the supraocular disc but the scales on the outer and anterior portion of the supraocular region smaller than the others; semicircles separated by two, partly by three, rows of large scales; occipital located with its posterior end on a line with the posterior end of the semicircles; scales of the occipital region enlarged and swollen, the outer ones largest; about two rows of scales between the occipital and the semicircles; two or three rows of superciliary shields not clearly differentiated; canthus rostralis consisting of three large scales, the first elongate and in contact with two superciliary scales that are also elongate; all of these scales on the top of the head swollen, slightly keeled, and, with the exception of the small supraocular scales, uniformly enlarged; a well-developed series of strongly keeled suboculars continued backward as a supratympanic series; six supralabials to the middle of the eye; a series of three or four rows of small scales separating the supralabials from the suboculars; above the angle of the mouth and in front of the lower edge of the ear a large tubercular shield; above it about the middle of the front edge of the ear two large shields, preceded by a third, all three tubercular; below the angle of the mouth a few tubercular scales, irregularly arranged; five infralabials to the middle of the eye; a single row of very large, keeled malar scales, and two anterior ones in contact with the infralabials, the rest separated from the infralabials by one or two rows of small scales; dorsal and ventral scales small, about eleven contained in the vertical diameter of the tympanum; from the nuchal fold along the median line of the neck and back a row of low, blunt spines, the largest slightly over a centimeter high; this crest interrupted on the shoulders and rump, thirty-seven spines between these two points; upper surface of limbs with slightly imbricated, keeled, posteriorly pointed scales considerably larger than the body-scales; scales covering the upper surface of the fore arm and tibia much larger than those covering the upper arm and femur; on the upper arm about eight, on the lower about five of these scales to the vertical diameter of the tympanum; a single series of twenty-two femoral pores; inner side of second toe with one comb, of third toe with two combs, each consisting of three lobes; tail compressed, covered with obliquely keeled scales in vertical rows, forming faintly indicated verticils; tail surmounted by a serrated crest similar to the body-crest but formed of slightly larger spines.

Coloration:— Ground tone of dorsal surface brownish gray; whole dorsal surface sprinkled with pale, yellowish green, the spots very abundant and partly confluent posteriorly; flanks marked by four broad, vertical stripes of pale bluish gray; each stripe edged dark slaty gray, sides and upper surface of the head broadly blotched with pale bluish yellow; sides of the tail with a series of irregular vertical stripes of bluish gray becoming regular and evenly spaced posteriorly, ventral surface somewhat lighter than the upper surface.

Variation and remarks:— A very young specimen, a female measuring only 115 millimeters from snout to vent, collected at Belig, Cabo Cruz, Cuba, by O. Tollin and now in the collection of C. T. Ramsden varies greatly in color from the adult, but the lepidosis of the specimen is very similar to that of the adult. In this example the ground tone of the dorsal surface is grayish blue tinged with greenish; along the middle line of the back there is a series of broad white crossbars edged broadly before and behind with black; these black and white crossbars are continued on the sides as a series of wavy stripes, each stripe pointing obliquely backward; the ventral surface is paler than the dorsal, and is covered by broken continuations of the lateral stripes.

Material examined.

M.C.Z.	No. of Specimens	Age	Sex	Locality	Date	Collector	Remarks
11050	1	Adult	male	Valley of Luis Lazo, Cuba	1915	C. de la Torre and T. Barbour	Described
8456	1	hf. grown	male	Guantanamo	1913	C. T. Ramsden	
6915	1	adult	male	Santiago de Cuba	1903	Wirt Robinson	
10966 10967	2	adult and juv.	males	Los Indios Isle of Pines		G. A. Link	

Cyclura caymanensis, sp. nov.

Plate 3.

Type, an alcoholic skin, M. C. Z., 10534, Cayman Islands, probably from Cayman Brac, 1911, W. W. Brown, Jr.

This species is so closely related to *C. macleayi* from Cuba that a detailed description is superfluous. The distinguishing characters of the species are adequately presented in the following diagnosis.

Diagnosis:— Scales covering the upper surface of the snout somewhat similar to those of *C. macleayi;* enlarged frontal shield separated from the prefrontals by five irregular rows of small scales instead of two rows of large ones as in *C. macleayi.* Scales of the frontoparietal region much smaller and more numerous than those of *C. macleayi.* Supraorbital semicircles not differentiated from the frontoparietal scales. Canthus rostralis consisting of three short, rather oblong scales, all about the same size. Dorsal crest not interrupted on either shoulders or rump, not reduced at all on the shoulders, considerably reduced on the rump; forty-four scales in the dorsal crest from shoulders to rump, all spines of this section very low, scarcely over 2 mm. high; spines of the neck and tail-crest about twice as high as these on an average. Limiting row of each verticil formed of scales several times as large as the other verticil scales, the row preceding the limiting row somewhat wider than the other rows. Coloration like *C. macleayi* but very much paler and grayer; an indication of regular pale yellow blotches along the median line of the back; no stripes or markings on the sides.

Habitat:— Cayman Brac and Little Cayman.

Remarks:— Garman (Bull. Essex inst., 1888, **20**, p. 105; author's separate p. 5) quotes Maynard to the effect that "The Iguana occurs commonly in the cliffs of both this island and Little Cayman." He was discussing the island of Cayman Brac. During the autumn of 1915 this island was visited by the most terrific hurricane of historic times. The whole terrestrial fauna of the island is said to have suffered very seriously.

Material examined.

We have only seen a single specimen of this species, the type.

CYCLURA BAEOLOPHA Cope.

Plate **4**, **5**, **6**; Plate **13**, fig. 1, 2.

Cope, Proc. Acad. nat. sci. Phil., 1887, p. 123. Barbour, Mem. M. C. Z., 1914, **44**, p. 298.

Diagnosis:— Nasals broadly in contact with the rostral. Prefrontal region covered by a pair of rectangular supranasals broadly in contact in the middle line of the snout; each supranasal in contact with a pair of narrow prefrontals which are followed by a very large posterior prefrontal; the anterior and posterior prefrontals form a median suture continuous with the nasal and supranasal suture,— all of these scutes covering the upper surface of the snout strongly convex, even tubercular. Frontal region between the prefrontals and the supraorbital semicircles covered by several rows of large irregular scales; the row in contact with the prefrontals consisting of very large scales, the largest being about a third as large as the posterior prefrontal; between the semicircles on a line with their anterior end a single large flat scale. Supraorbital semicircles formed of large tubercular scales clearly differentiated from the slightly swollen scale of the supraorbital and frontal regions; semicircles separated by two partly by four rows of scales. Occipital region covered with scales slightly larger than the frontoparietals, the outer rows much larger than the others; two rows of scales between the occipital and the semicircles. Canthus rostralis consisting of a single large canthal scale and a short squarish precanthal, both swollen and slightly keeled; the canthal scale in contact with two elongate supraciliaries. Dorsal crest formed of low blunt spines, the largest about half a centimeter high; this crest broadly interrupted on the shoulders and rump; 56 spines between these two points. Color above brownish green, tinged on the head, shoulders and along the mid line of the back with pale yellowish green.

Habitat:— Andros Island, Bahamas.

The most abundant species still existing in the Bahamas.

Description:— Adult male, M. C. Z., 6979, Andros Island, Bahamas, 1904, Harvard Bahama Expedition of 1904.

Rostral as wide as the mental, broadly in contact with the nasals, nasal large, ovoid, and perforated in the posterior half by a somewhat semicircular nostril; each nasal in contact with a rectangular supranasal and a slightly larger, triangular postnasal; nasals and supranasals broadly in contact in the middle of the snout; each supranasal in contact with a pair of narrow prefrontals which are followed by a very large posterior prefrontal; the anterior and posterior prefrontals form a median suture continuous with the nasal and supranasal suture; all of these scutes covering the upper surface of the snout strongly convex, even tubercular; between the prefrontals and the supraorbital semicircles several rows of large irregular scales; the row in contact with the prefrontals consisting of several very large scales, the largest being about a third as large as the posterior prefrontal; between the semicircles on a line with the anterior end a single large flat scale; the semicircles formed of large tubercular scales clearly differentiated from the slightly swollen scales of the supraorbital or frontal regions; supraorbitals roughly hexagonal and uniform in size; supraorbital semicircles separated by two, partly by four rows of scales, occipital located with its posterior end on a line with the posterior end of the semicircles; scales of the occipital region slightly larger than the frontals, the outer row of occipitals much larger than the others; two rows of scales between the occipital and the semicircles; two or three rows of superciliaries, a single large canthal scale and a short squarish precanthal on each side; canthal scale in contact with two elongate superciliaries, the whole series swollen and slightly keeled; a well-developed series of strongly keeled suboculars continued backward as a supratympanic series; eight supralabials to the middle of the eye, a series of three or four rows of small scales separating the supralabials from the suboculars; on the anterior edge of the ear three enlarged tubercular scales, preceded by a group of smaller ones, the larger one of which is located above the angle of the mouth near the ear; below the angle of the mouth a regular series of tubercular scales decreasing in size anteriorly; seven infralabials to the middle of the eye; a single row of very large, swollen malar scales; the two anterior ones in contact with the supralabials, the rest separated by a single row of small scales; dorsal and ventral scales small, about eleven contained in the vertical diameter of the tympanum; from the nuchal fold along the median line of the neck and back, a row of very low blunt spines, the largest about half a centimeter high; this crest interrupted broadly on the shoulders and rump; fifty-six spines in the dorsal crest between these two points; upper surface of limbs with slightly imbricated, keeled, posteriorly pointed scales; scales covering the upper surface of the fore arm and tibia much longer than those covering the upper arm and femur; on the upper arm about seven, on the lower about six of these scales to the vertical diameter of the tympanum; a single series of twenty femoral pores, inner side of second toe with one comb, of third toe with two combs, each consisting of three lobes; tail compressed, covered with obliquely keeled scales in vertical rows, tail surmounted by a serrated crest, similar to the body crest but formed of larger spines.

Coloration: — Ground color brownish green washed on the head and arms along the mid region of the back and tail, as well as on the ventral surface with pale yellowish green; the pale yellowish green of the head somewhat suffused with blue, especially on the dorsal surface.

Material examined.

M.C.Z.	No. of specimens	Age	Sex	Locality	Date	Collector	Remarks
5960	1	adult	female				
6979	1	adult	male	Mangrove Cay, Andros Island	1904	Bahama Exp. 1904	
6947	1	adult	male	Mangrove Cay, Andros Island	1904	Bahama Exp. 1904	
6975	3	Head of adult male 2 young	both	Mangrove Cay, Andros Island	1904	Bahama Exp. 1904	Described

Also four mounted specimens, two adult males, a female and young, Mangrove Cay, Andros Island, Bahama Exp. of 1904.

Cyclura inornata, sp. nov.

Plate **14.**

Type, an adult female, M. C. Z. 11062, U. Cay in Allen's Harbor, near Highborn Cay, Bahamas, March 2, 1915, C. J. Maynard.

Diagnosis. Nasals broadly in contact with the rostral. Prefrontal region covered by a pair of elongate supranasals, broadly in contact with the middle line of the snout, immediately followed by two pairs of prefrontals and a fifth scale which is intercalated at the crossing point of the sutures, the posterior pair several times as large as the anterior pair; both pairs of prefrontals broadly in contact in the middle line of the snout. Frontal region covered by a transverse row of four large scales in contact with the prefrontals and by two more large scales mesially arranged and separated from the transverse row by a single row of small scales. Supraorbital semicircles not apparent, but the scales of the supraocular region much smaller than those of the frontoparietal regions. Canthus rostralis consisting of a very elongate canthal scale preceded by a small precanthal; all these scales on the top of head very slightly swollen, some scarcely keeled. Dorsal crest consisting of very low blunt spines, the largest scarcely three millimeters high, this crest greatly diminished but not interrupted on the shoulders, widely interrupted, however, on the rump, sixty spines from shoulder to rump. Color above grayish brown sprinkled very slightly with yellowish gray; spinal region tinged with straw color; sides of the snout blackish; gular region chalky white in strong contrast to the rest of the ventral surface.

Habitat.— U. Cay in Allen's Harbor, Highborn Cay, Bahamas. Probably now extinct.

Description of Type.— Rostral as wide as the mental, broadly in contact with the nasals; nasal large, somewhat ovoid, perforated by a large ovoid nostril; each nasal in contact with an elongate supranasal and a triangular postnasal; nasals barely, supranasals broadly in contact in the middle line of the snout; supranasals immediately followed by two pairs of prefrontals and a fifth scale incalated at the crossing point of the sutures; the posterior pair several times as large as the anterior pair; both pairs of prefrontals broadly in contact in the middle line; no definite supraorbital semicircles; scales of the supraocular region much smaller than those of the frontal region; in contact with the prefrontals a transverse row of 4 large scales; separated from this row by a single row of small scales two more large scales mesially arranged, occipital located well forward and flanked on either side by a group of scales larger than those of the frontal region; frontal region covered by scales somewhat larger than those of the occipital region; two or three rows of superciliary shields not clearly differentiated; canthal scale very elongated, preceded by a small prefrontal, all these scales of the top of head very slightly swollen, some scarcely keeled; a well-developed series of keeled suboculars continued backward as a supratympanic series, eight supralabials to the middle of the eye; a series of four or five rows of small scales separating the supralabials from the suboculars; on the anterior edge of the ear a single row of large, strongly tubercular scales preceded by a group of smaller, tubercular scales grading off in size anteriorly; below the angle of the mouth a group of large tubercular scales, in close contact with each other, grading off in size anteriorly; eight infralabials to the middle of the eye; a single row of large slightly swollen malar scales; a disconnected single row of small scales between some of the malars and infralabials; dorsal scales slightly larger than the ventrals, about twelve contained in the vertical diameter of the tympanum; from the nuchal fold along the median line of the neck and back a row of very low blunt spines, the largest scarcely three millimeters high; the crest greatly diminished but not interrupted, however, on the rump; 60 spines in the dorsal crest from shoulder to rump; upper surface of limbs with slightly imbricated, keeled posteriorly pointed scales, considerably larger than the body-scales; scales covering the upper surface of the fore arm and tibia much larger than those covering the upper arm and femur; on the upper arm about nine on the lower about seven of these scales to the vertical diameter of the tympanum; a single series of twenty-one femoral pores; inner side of the second toe with one comb of third with two combs, each consisting of three lobes. Tail compressed, covered with obliquely keeled scales in vertical rows, forming distinct verticils; tail surmounted by a serrated crest, similar to the body crest, but formed of slightly longer spines anteriorly.

Coloration. Ground tone of dorsal surface grayish brown, sprinkled very slightly with yellowish gray; the dorsal crest and spinal region tinged with straw color; upper surface of the head tinged with bluish; muzzle and sides of head brownish black, gular region chalky white in strong contrast to the rest of the ventral surface; whole ventral surface somewhat lighter than dorsal surface; limiting row of the verticils bluish gray.

Materia examined.

We have only seen a single specimen of this species, the type.

CYCLURA RILEYI Stejneger.

Plate **7**; Plate **15**, fig. 3, 4.

Stejneger, Proc. Biol. soc. Wash., 1903, **16**, p. 129.

Diagnosis:— Nasals broadly in contact with the rostral. Scales of the top of head flat or only slightly swollen. Prefrontal region covered by a pair of elongate supranasals in contact with the nasals and also in contact with each other, each supranasal followed by two large prefrontals, the posterior the larger, the prefrontals of each side in contact with each other but separated from the series of the opposite side by two rows of large scales. Top of head behind prefrontals covered with numerous small scales; the scales of the supraocular region much smaller than the others; except for a grouping of a few large scales on each side of the occipital, and a semirosette of enlarged scales in the frontoparietal region, these scales without a definite arrangement. Canthus rostralis consisting of a group of three scales, the canthal and precanthal about the same size and larger than the third scale. Dorsal crest interrupted on both shoulders and rump, formed of scales of varying height; nuchal section formed of about twenty spines about the same in width and varying from one to ten millimeters in height, according to the proximity to the extremities of the series, back section formed of seventy-six spines, scarcely over a millimeter in height, except for the last fourteen spines which average about 5 millimeters; caudal section formed of heavier spines than those of the back, about 4 millimeters in height. Limiting row of each verticle clearly differentiated. Ground color, bluish gray, heavily blotched with confluent tawny yellow spots except on the posterior ventral surface, which is uniform yellowish gray; head very much paler, tail darker than the rest of the body.

Habitat:— Two small cays in the large salt water lagoon on Watlings Island.

Description:— Adult male, M. C. Z. 10918, Watlings Island, Bahamas, April, 1915, W. W. Worthington.

Rostral as wide as the mental broadly in contact with the nasals; nasals very large, about the size of the posterior prefrontals, broadly hexagonal, in broad contact with each other; each nasal perforated posteriorly by an elongate nostril; each nasal in contact with an elongate supranasal and two postnasals; nasals and supranasals broadly in contact in the middle line of the snout; immediately following the supranasals and separated by a double row of scales, two large smooth prefrontals on each side, the posterior pair the larger; these scales between the prefrontals as large as the scales covering the frontal region; top of head behind the prefrontal region covered by small, irregular polygonal shields, those on the supraocular region much smaller than the others; three poorly indicated rosettes of larger scales, one on the frontoparietal region and one on each side of the occipital, each rosette consisting of a somewhat rounded scale surrounded by a circle of subrectangular scales; all shields on the top of head smooth or very slightly swollen, occipital somewhat larger than the adjacent scutes; superciliary shields slightly larger than the supraorbitals; the first two and the last two scales of this series somewhat elongate, canthal scale preceded by a somewhat squarish precanthal of about the same size, a small subcanthal in contact with the canthal scale anteriorly; 2 loreal scales between precanthal and postnasal, squarish, not much smaller than precanthal; the rest of the loreal scales small and elongate, a series of strongly keeled suboculars not reaching the tympanum; temporal shields small; on the anterior edge of the tympanum just above the angle of the mouth a group of three or four large tubercular scales; below the angle of the mouth five regular rows of enlarged round scales, the series running obliquely forward; supralabials low, six to below the center of the eye. Lower labials larger than the supralabials, six to the center of the eye; two rows of large molar scales separated posteriorly from the infralabials by a single row of smaller scales; on each side of the jaws below the angle of the mouth five or six regular rows of rounded scales; dorsal crest interrupted on both shoulders and rump; nuchal section of the crest consisting of twenty spines all of about the same width, varying in height from one millimeter at the ends of the series to ten millimeters in the center; back section formed of seventy-six spines scarcely over a millimeter in height, the last fourteen spines, however, over five millimeters in height; caudal section formed of heavy spines about four millimeters in height; scales on the upper side of the arms larger than the dorsal scales, those on the fore arm a trifle larger than those on the upper arm; a single series of twenty-three femoral pores; inner side of second toe with one "comb," of third toe with two "combs" each consisting of three lobes; tail covered with faintly indicated verticils.

Coloration:— Ground color bluish gray, heavily blotched with confluent tawny yellow markings; upper and lateral surfaces of head very pale yellow; tail and hind limbs darker than the rest of the body.

Material Examined.

M.C.Z.	No. of speci-mens	Age	Sex	Locality	Date	Collector	Remarks
10918	1	adult	male	Watling's Island	1909	W. W. Worthington	Descrip.
9272	1	adult	male	Watling's Island	1903	J. H. Riley	Para-type

CYCLURA NUCHALIS, nov. sp.

Plate 8, fig. 1, 2.

Type, an adult, Acad. Nat. Sci. Phil. 11985, Fortune Island, Bahamas. Collection of Arthur Erwin Brown.

Since this species is in general similar to *C. rileyi* no detailed description is necessary, the differences being expressed in the following diagnosis.

Diagnosis:— Nasals broadly in contact with the rostral. Scales of the prefrontal and frontoparietal regions similar to those of *C. rileyi;* enlarged frontal scale proportionately larger, surrounding scales proportionally smaller than those of *C. rileyi;* supraorbital semicircles distinct posteriorly, formed of slightly tuberculate scales. Occipital scales more tuberculate than those of *C. rileyi.* Prefrontal scale more elongate than that of *C. rileyi.* Dorsal crest very different from that of any other Cyclura. This crest interrupted on the shoulders, widely interrupted on the rump; nuchal section formed of fourteen wide spines, the three central ones largest, about a centimeter high, the rest grading off in size toward the extremities; of these three central spines the most anterior one about half a centimeter wide at the base, in other words about twice as broad as any of the others; the crest running from shoulders to rump scarcely over a millimeter high, composed of sixty-two spines; caudal crest slightly higher than that of the back. Scales of the limiting row of each verticil only slightly larger than other scales of the verticil; about five scales in the bulge of each limiting row while *C. rileyi* averages four or less. The type of coloration similar to that of *C. rileyi* but the ground color brownish gray instead of blue-gray; general tonality of the head grayish brown instead of straw color.

Habitat:— Fortune Island, just to the south of Long Island, Bahamas.

Material examined.

The type only is known.

CYCLURA CARINATA Harlan.

Plate **8**, fig. 3, 4; plate **13**, fig. 3, 4.

Harlan, Journ. Acad. nat. sci. Phil., 1824, **4**, p. 242, 250, pl. 15.
Barbour, Mem., M. C. Z., 1914, **44**, p. 299.

Diagnosis: — Nasals broadly in contact with the rostral. Prefrontal region covered by a pair of irregular supranasals; nasals and supranasals of each side separated from each other by a single large scale. Frontal, frontoparietal, and occipital regions covered by uniformly small scales, irregular in shape and strongly keeled. Supraorbital semicircles not differentiated but the scales of the supraocular region smaller than the other supracephalic scutes. Two large, vertically arranged canthal scales on each side. Dorsal crest broadly interrupted on the shoulders and rump; the neck-crest half a centimeter high, the body-crest only three millimeters high; color above brownish gray, with numerous but faint reticulations; head tinged with blue, chest with smoky.

Habitat: — Turks Island, Southern Bahamas.

Description: — Adult male, M. C. Z. 1252 Turk's Island, Southern Bahama Islands, 1862, A. S. Bickmore.

Rostral as wide as the mental, broadly in contact with the nasals; nasals of medium size, somewhat pentagonal perforated posteriorly by a semicircular nostril; each nasal in contact with a large pentangular postnasal and a pair of irregular supranasals; nasals and supranasals of each side separated from each other by a single, large triangular scale, all the rest of the scales of top of head small and irregular, no enlarged prefrontal, frontal or parietal scales; a very slight indication of a supraocular disk; scales of the supraocular and supraciliary region as well as the outer parietal region somewhat smaller than the rest of the supracephalic scales; scales of the prefrontal, frontal, and occipital region irregular and all about the same size, while the scales of the supraocular and outer parietal regions are uniformly smaller; occipital rather large and located well forward; all scales of the top of head strongly keeled but hardly tubercular; two large, vertically arranged canthal scales on each side; a well-developed series of slightly keeled suboculars carried back a trifle beyond the orbit, ten supralabials to the middle of the eye; a series of three or four rows of small scales separating the supralabials from the suboculars; no tubercular or swollen scales in the temporal region, only a few enlarged scales below the angle of the mouth, eleven infralabials to the middle of the eye; a double row of small slightly keeled malar scales separated from the infralabials by one or two rows of scales of the small size; dorsal and ventral scales small; from the nuchal fold along the median line of the neck and back a row of blunt spines; on the neck the spines about half a centimeter high; the crest broadly interrupted on the shoulders and rump; forty-seven spines in the dorsal crest between these two points, the first four and the last four spines of this series very much reduced, the largest spine about three millimeters high; upper surface of limbs with slightly imbricated, keeled, posteriorly pointed scales considerably larger than the body-scales; on the upper arm about twenty on the lower arm about twelve of these scales to the vertical diameter of the tympanum; twenty-three femoral pores; inner side of second toe with one comb, of third toe with two combs each consisting of three prominent and two small lobes; tail compressed, covered with obliquely keeled scales in vertical rows, forming distinct verticils; the limiting row of each verticil formed of strongly keeled scales; tail surmounted by a serrated crest, similar to the body-crest but formed of larger and sharper spines.

Coloration: — Ground tone of dorsal surface brownish gray; numerous but very faint yellow-brown reticulations extending from head to tail; these reticulations forming faint yellowish blotches on the head; tail uniformly yellowish gray; sides of head and gular region tinged with blue; chest smoky; rest of ventral surface the same color as tail.

Material examined.

The specimen described.

CYCLURA COLLEI Gray.

Plate **9**; Plate **15**, fig. 5, 6.

Gray, Cat. lizards British mus., 1845, p. 190. Barbour, Mem. M. C. Z., 1914, **44**, p. 298.

Diagnosis: — Nasals separated from the rostral by several rows of fine granules. Prefrontal region covered by a series of three large shields on each side, each shield slightly swollen and convex; the series separated by a double row of rather large irregular scales. Frontal and frontoparietal regions with small and irregular scales very slightly keeled, each scale depressed so as to make the interstices stand out like a network. Supraorbital semicircles differentiated only posteriorly where they are formed of broad, slightly keeled scales. Occipital region with a huge swelling on each side, each covered with flat scales. Canthus rostralis formed of a group of three, medium sized keeled scales. Dorsal crest not interrupted on either shoulder or rump; largest spine about a centimeter in length; fifty spines in the crest from shoulders to rump. Color above mud-gray washed with green anteriorly; a series of straw color stipplings covering the dorsal and lateral surfaces, these stipplings uniting into blotches posteriorly.

Habitat: — Jamaica, where it is now exceedingly rare, being only found on a few islets off the coast where the mongoose has not been introduced. The mongoose eats the eggs and the very young.

Description: — Adult male, M. C. Z. 9397 Goat Island, near Old Harbour, Jamaica, 1914, Arthur Perrin.

Rostral wider than mental, separated from the nasals by several rows of very fine granules; nasal large, ovoid and perforated on the posterior half by a large semicircular nostril; immediately behind and adjoining the nasal, a series of three large shields, slightly swollen and a trifle convex; the series separated by a double row of rather large irregular scales; the last pair of scales in the series about twice as large as the anterior pair; the scales of each series broadly in contact with each other without any intervening scales; a pair of large triangular postnasals; scales of the frontoparietal region all small and irregular, each scale depressed so that the interstices stand out like network; supraorbital semicircles only evident posteriorly, formed of broad, slightly keeled scales; scales covering the supraocular region smaller than those of the frontal region, each scale very slightly keeled; occipital smaller than nasals, located well forward between the semicircles from which it is separated by three rows of scales; occipital region swollen out into a pair of huge humps, each covered with a group of rather large, flat, slightly keeled scales; two rows of strongly keeled supraciliaries; canthus rostralis consisting of a group of three, medium sized keeled scales; a well-developed series of strongly keeled suboculars continued backward as a supratympanic series to above the middle of the ear; six supralabials to the middle of the eye; a series of very small scales separating the suboculars and the supralabials; above the angle of the mouth and in front of the lower edge of the ear three large tubercular shields in a horizontal row; above them along the edge of the ear three or four rows of smaller scales, strongly tubercular and grading off in size anteriorly; below the angle of the mouth a few scattered enlarged scales, each surrounded by a circle of granules; seven lower labials to the center of the eye; a row of enlarged malar scales, the posterior ones strongly keeled and separated from the infralabials by a single row of fairly large scales of which the posterior ones are also keeled; dorsal and ventral scales small, about thirteen contained in the vertical diameter of the tympanum; from the nuchal fold along the median line of the neck and back a series of medium sized spines, not interrupted or greatly reduced on the shoulders, and only decreased in size on the rump; the longest spines about a centimeter in length; fifty spines in the crest from the shoulders to the rump; upper surface of the limbs with slightly imbricated, keeled, posteriorly pointed scales somewhat larger than the dorsals; on the lower arm about eleven, on the upper about fifteen of these scales to the vertical diameter of the tympanum; a single series of eighteen femoral pores; inner side of second toe with one comb, of the third toe with two combs, each consisting of three large and two small lobes; tail compressed, covered with obliquely keeled scales in vertical rows forming distinct verticils; tail surmounted by a row of spines slightly larger than, but continuous with, those of the body-crest.

Coloration: — Ground tone of dorsal surface brownish gray, almost a mud color; top of snout, sides of head washed with green; lower labials yellowish green; dorsal and lateral surfaces of the body faintly blotched with straw color, the blotches often breaking up into groups of small spots; upper surface of the thighs, sides of tail profusely blotched with the same color; ventral surface muddy gray; the legs tinged slightly with green.

Material examined.

The specimen described.

CYCLURA CORNUTA (Bonnaterre).

Plate 10.

Bonnaterre, Tabl. encyc. erpet., 1789, p. 40, pl. 4, f. 4. Stejneger, Rept. U. S. N. M. for 1902, 1904, p. 670, f. 122–126.

Diagnosis: — Nasals separated from the rostral by a single row of scales; nasals separated from each other by two rows of scales. Prefrontals in a double series of three large shields, strongly convex, the posterior pair particularly so, the two rows separated from each other by several rows of small scales, the posterior pair of prefrontals separated from the median frontal tubercle by a single row of very narrow scales. Supraorbital semicircles scarcely differentiated from the supraocular scales but somewhat larger than the frontoparietal scales. A single large canthal scale preceded by a small, hexagonal precanthal. Dorsal crest low, not over four millimeters high, reduced on the shoulders, nearly interrupted on the rump but not a distinct break in the whole. Verticils faintly indicated, the limiting row only a trifle larger than the row preceding it. Color very faded in the specimens examined, but probably uniform olive-gray in life, slightly more yellowish on the head and under surface.

Habitat: — Haiti.

Description: — Two specimens, a young one, and the head of a half grown individual M. C. Z. 3597, Jeremie, Haiti, 1859, D. F. Weinland.

Rostral wide, as wide as mental, separated from the nasals by a single row of scales; nasals large, ovoid, perforated by large nostrils posteriorly, separated from each other by two rows of scales; on each side of the top of the snout, immediately following and adjoining the nasals two rows of three large shields, strongly convex, the posterior pair tubercular, the rows separated from each other by two or three rows of small scales; of these two rows of large scales the posterior pair is nearly as long as the two others together; a large median frontal tubercle separated from this posterior pair of prefrontals by a single row of narrow scales; supraocular semicircles scarcely differentiated, but slightly larger than the supraorbital scales and distinctly larger than the frontoparietals; occipital located well forward between the semicircles from which it is separated by two or three rows of small scales, situated on a line between the posterior borders of the orbits; a single large canthal scale preceded by a small, hexagonal precanthal; a well-developed series of strongly keeled suboculars continued backward as a supratympanic series to above the ear; seven supralabials to below the middle of the eye; two or three rows of granules separating the suboculars from the supralabials; above the angle of the mouth and in front of the lower edge of the ear a large tubercular shield, above it about the middle of the edge of the ear another tubercle almost as large; nine lower labials to the center of the eye; a series of enlarged malar scales, the posterior ones strongly keeled and separated from the lower labials by four rows of small scales; from the nuchal fold along the median line of the body a series of low spines which is much reduced between the shoulders, nearly interrupted on the rump; fifty spines on the back between these two points; upper surface of the limbs with slightly imbricated, keeled, posteriorly pointed scales, somewhat larger than the dorsals; on the lower arm about seven, on the tibia about five to the vertical diameter of the tympanum; a single series of about seventeen femoral pores; inner side of second toe with one "comb" of third toe with two combs each consisting of three main and two smaller lobes; tail covered with faintly indicated verticils; tail surmounted by a crest of heavy spines, a trifle larger than the back spine.

Coloration: — The color of both specimens is very faded, but it was probably uniform olive-gray in life, perhaps slightly more yellowish on the head and under surface.

Material examined.

The specimens described.

Cyclura nigerrima Cope.

Plate **11**; Plate **15**, fig. 1, 2.

Cope, Amer. nat., 1885, **19**, p. 1006.

Diagnosis:— Very similar to *C. cornuta* from which it may be distinguished by the following characters:—

Nasals separated from the rostral by two rows of scales, one of the rows of very large scales. Nasals separated from each other by three, and in part by four rows of scales. Prefrontals separated from the large median frontal scales by two rows of scales. Supraorbital semicircles not apparent but this may be due to the old age of the specimen. Precanthal scale as large or a trifle larger than canthal scale, both subrectangular or squarish. Dorsal crest low, interrupted on both shoulders and rump, forty-nine spines in the crest between these two points. Verticils similar to those of *C. cornuta* but very indistinct, the bulge not very prominent. Color indeterminable through fading, but probably not unlike that of *C. cornuta.*

Habitat:— Navassa Island.

Description:— The diagnosis given above is sufficient to characterize the species quite adequately. It is so similar to *C. cornuta* that no detailed remarks are necessary.

Material examined.

The diagnosis was taken from M. C. Z. 4717, Navassa Island, received from the Smithsonian Institution. Cope states (Proc. Amer. philos. soc., 1886, **23**, p. 264) that his description of *nigerrima* was taken from a specimen partially skeletonized. He then proceeds to diagnose *C. onchiopsis,* a synonymous form, also from Navassa Island and based upon three specimens in the U. S. N. M. We strongly suspect that our specimen is one of the types of *onchiopsis.* It was received in Cambridge before the appearance of Cope's paper, but it is known that Cope often drew up notes and descriptions of species and frequently subjected them to long delays before they actually appeared in print. Our specimen agrees remarkably with Cope's description and Dr. Stejneger writes me that he has not found the specimens which Cope refers to in the National Museum.

There is also a fine mounted adult male in the M. C. Z. said to come from Navassa Island and representing this species. It was presented by the N. Y. Zoölogical Society.

CYCLURA STEJNEGERI, nov. sp.

Plate **12**.

Type, a young specimen U. S. National Museum 29367; Mona Island, August, 1901, B. S. Bowditch. Paratype M. C. Z. 11145, formerly U. S. N. M. 29365, an adult male having the same data.

Diagnosis:— Very similar to *C. cornuta* from which it may be distinguished by the following characters:—

Nasals in contact with the rostral; two, and in part three rows of scales between the nasals. Prefrontals separated from the enlarged median frontal scale by two rows of scales. A single large, elongate canthal scale preceded by three small precanthals. Dorsal crest much reduced between the shoulders, absolutely interrupted on the rump, fifty-one scales in the crest from shoulder to rump. Limiting row of each verticil not much wider than the other rows of the verticils. Color somewhat faded, uniform dark olive-green.

Habitat:— Mona Island.

Remarks:— No further discussion of this species is necessary in view of its similarity to *C. cornuta.* It may be added, however, that Stejneger when writing his Herpetology of Porto Rico, suspected the distinction between this species. He had, however, no Haitian material for comparison and was further deterred by some notes which Günther (Trans. Zool. soc. Lond., 1882, **11**, p. 218, pl. 44) published regarding a specimen with no locality which died in the London Zoo and to Stejneger it seemed unlikely that a specimen from Mona would find its way alive to London. We believe that this specimen really came from Mona Island, a possibility by no means so remote as Stejneger seemed to think, especially when the rarity of the species in Haiti is taken into account. It is not unlikely that the small Haitian sailing vessels may even visit Mona purposely, to take Iguanas for food. It is also not improbable that such individuals may be carried alive to Haiti and thence one may have found its way to London. (*Cf.* Stejneger's discussion of this specimen, Ann. rept. U. S. N. M. for 1902, 1904, p. 671).

Material examined.

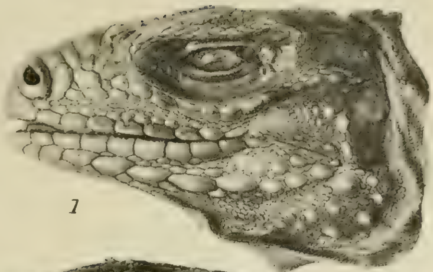
We have only seen Bowdish's specimens listed by Stejneger (*loc. cit.*). One of these is now in the M. C. Z., 11145, a paratype, figured.

PLATE 1.

PLATE 1.

Cyclura macleayi Gray.

Fig. 1.— Side view of head. M. C. Z. 8456. Guantanamo, Cuba.
Fig. 2.— Upper view of head of the same specimen.
Fig. 3.— Dorsal view of very young specimen. Belig, Cuba. Collection of C. T. Ramsden.



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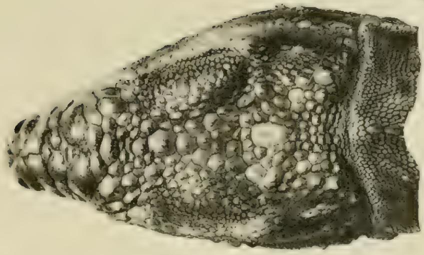

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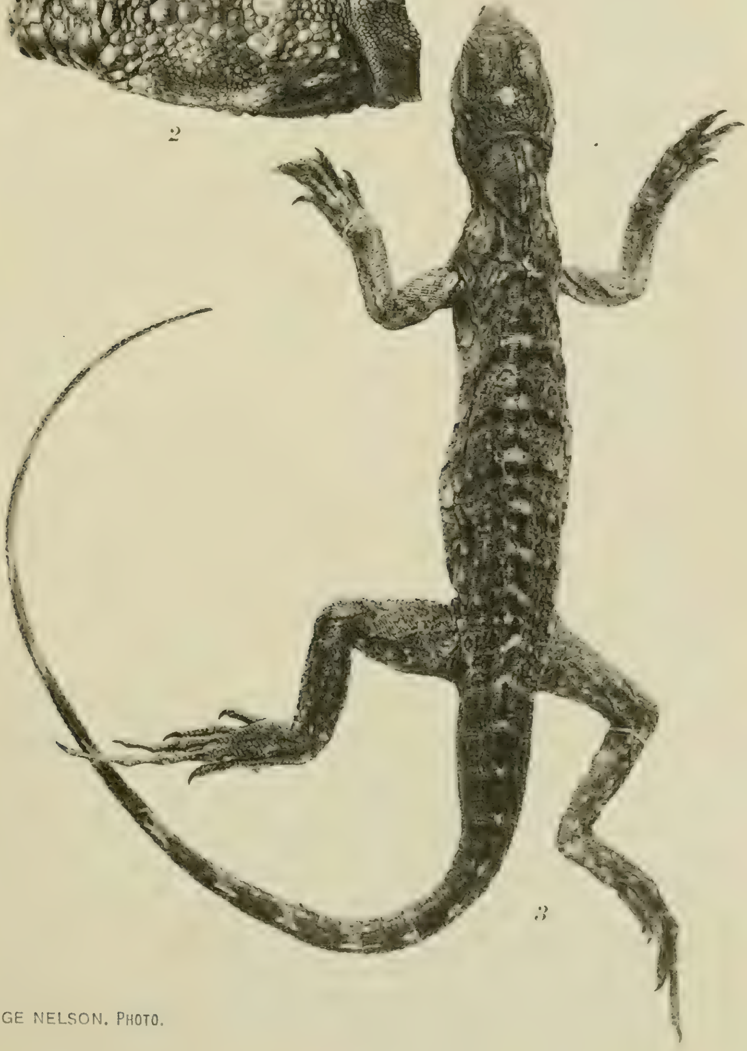

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GEORGE NELSON, PHOTO.

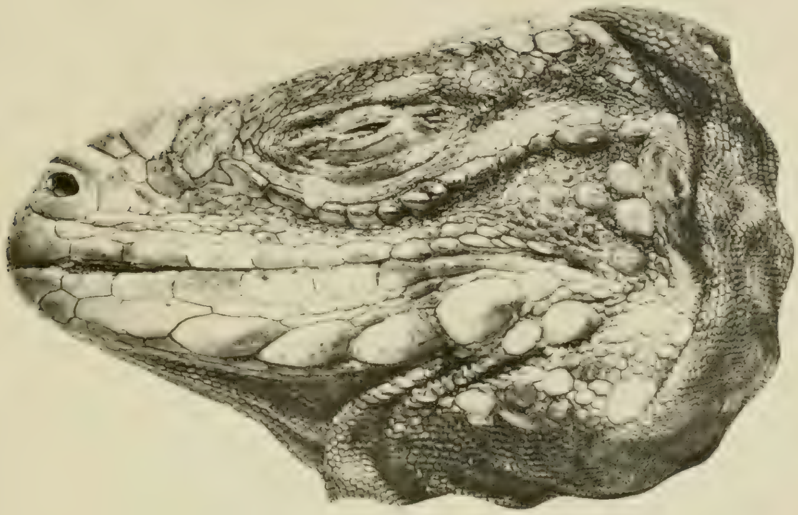
HELIOTYPE CO., BOSTON.

PLATE 2

PLATE 2.

Cyclura macleayi Gray.

Fig. 1.— Side view of head of adult male. M. C. Z. 11050. Luis Lazo, Cuba.
Fig. 2.— Upper view of head of the same specimen.



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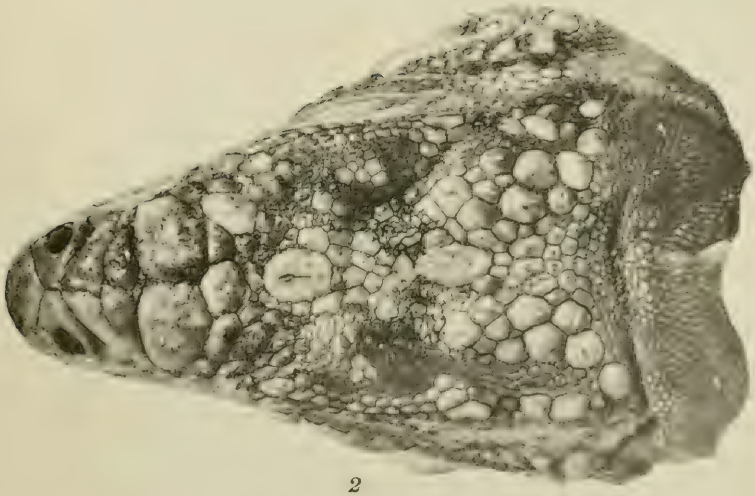

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GEORGE NELSON, PHOTO

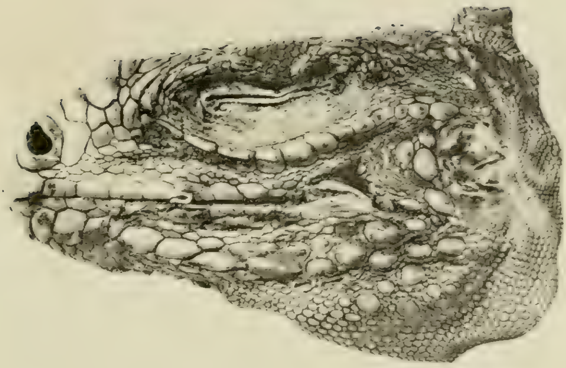
HELIOTYPE CO., BOSTON.

PLATE 3.

PLATE 3.

Cyclura caymanensis Barbour & Noble.

Fig. 1.— Side view of head. Type M. C. Z. 10534. Cayman Islands.
Fig. 2.— Upper view of head of the same specimen.



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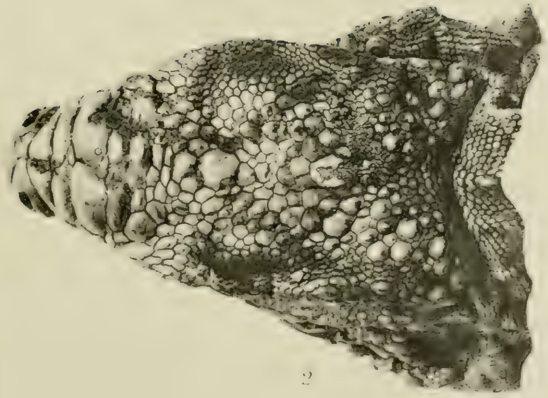

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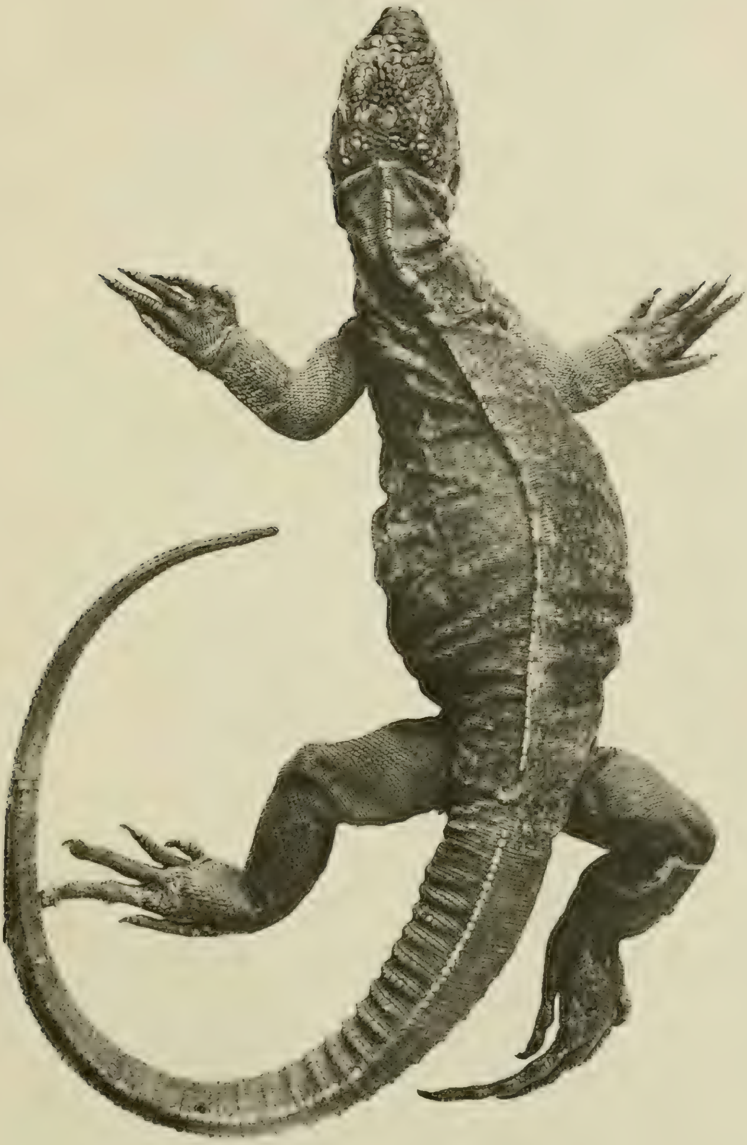
PLATE 4.

PLATE 4.

Cyclura baeolopha Cope.

Dorsal view of young specimen. M. C. Z. 6975A. Mangrove Cay, Andros Island, Bahamas.



GEORGE NELSON. PHOTO.

HELIOTYPE CO., BOSTON.

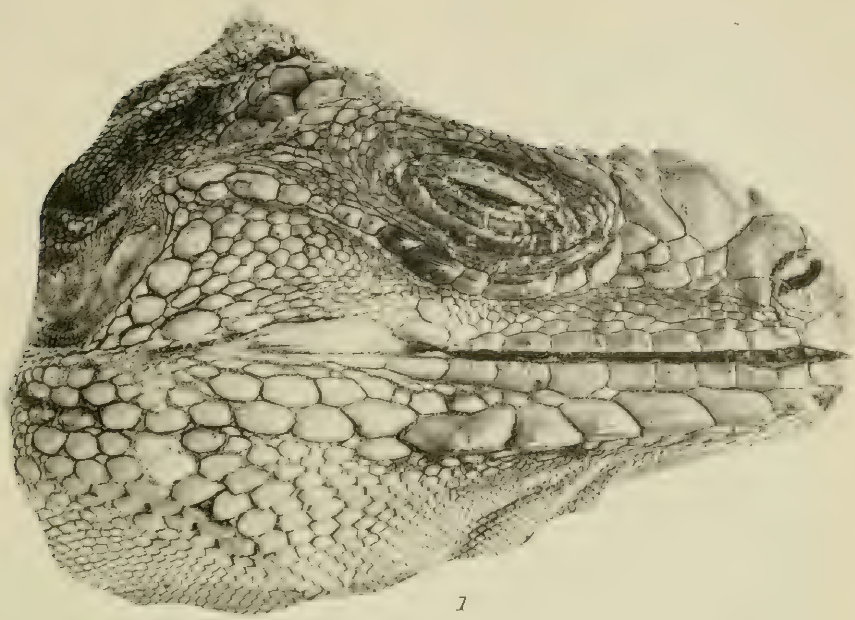
PLATE 5.

PLATE 5.

Cyclura baeolopha Cope.

Fig. 1.— Side view of head of adult male. M. C. Z. 6975B. Mangrove Cay, Andros Island, Bahamas.

Fig. 2.— Upper view of head of the same specimen.



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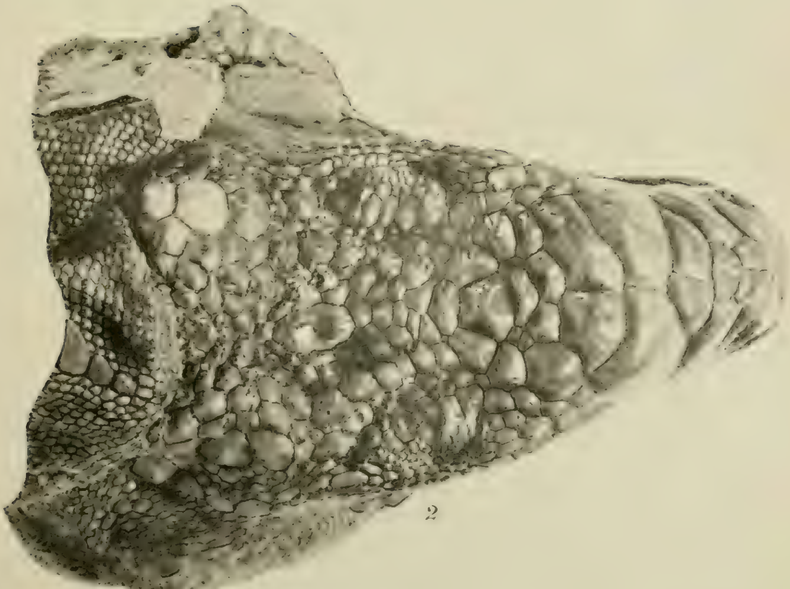

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GEORGE NELSON, PHOTO.

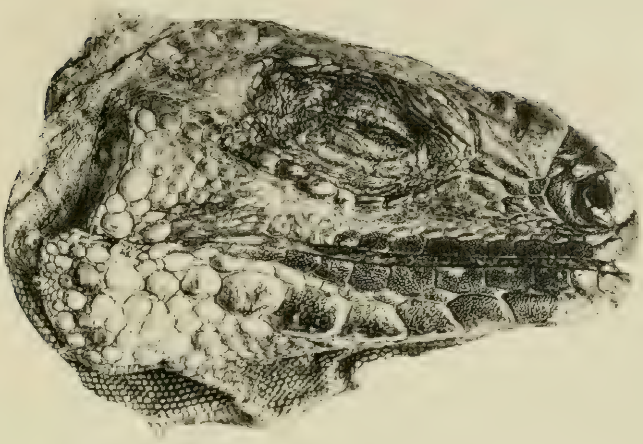
HELIOTYPE CO., BOSTON.

PLATE 6.

PLATE 6.

Cyclura baeolopha Cope.

Fig. 1.— Side view of head of adult female. M. C. Z. 5960.
Fig. 2.— Upper view of head of the same specimen.



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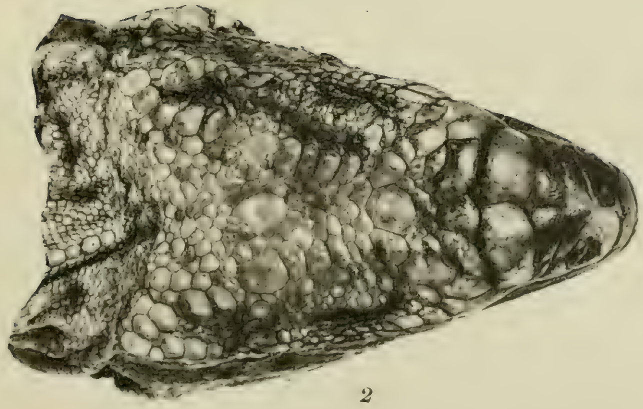

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GEORGE NELSON, PHOTO.

HELIOTYPE CO., BOSTON.

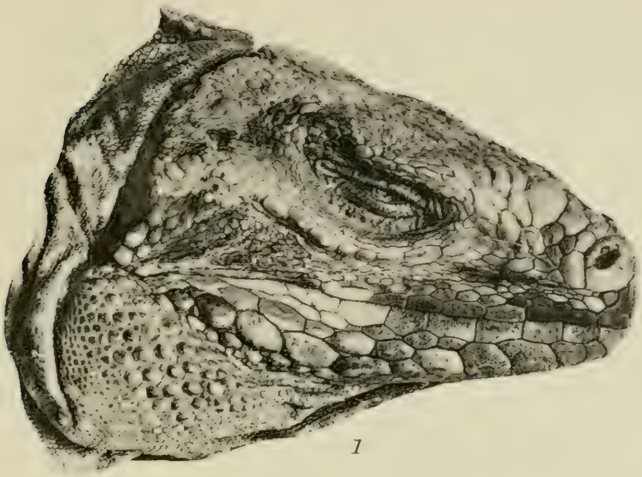
PLATE 7.

PLATE 7.

Cyclura rileyi Stejneger.

Fig. 1.— Side view of head of adult male. M. C. Z. 10918. Watling's Island, Bahamas.

Fig. 2.— Upper view of head of the same specimen.



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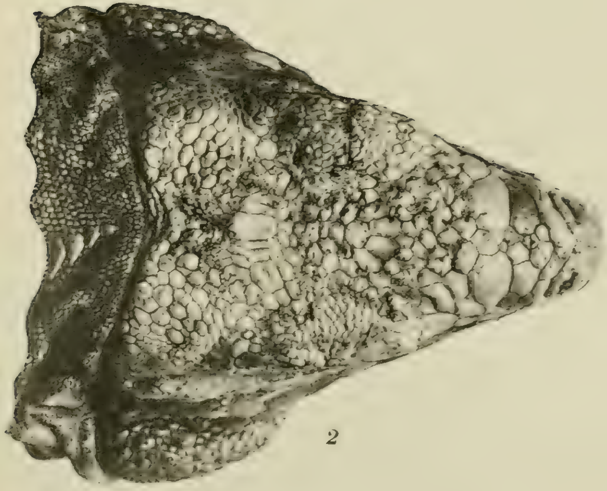

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GEORGE NELSON, PHOTO.

HELIOTYPE CO., BOSTON.

PLATE 8.

PLATE 8.

Cyclura nuchalis Barbour & Noble.

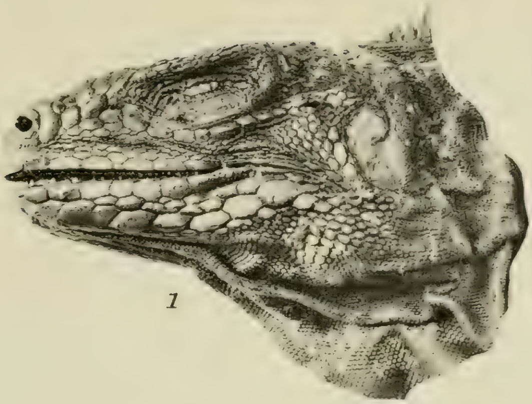
Fig. 1.— Side view of head. Type, Collection Acad. nat. sci. Phil., 11985. Fortune Island, Bahamas.

Fig. 2.— Upper view of head of the same specimen.

Cyclura carinata Harlan.

Fig. 3.— Side view of head of adult male. M. C. Z. 1252. Turk's Island, Southern Bahamas.

Fig. 4.— Upper view of head of the same specimen.



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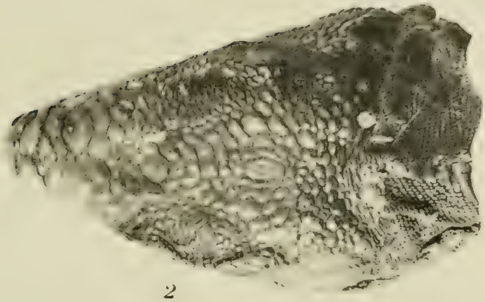

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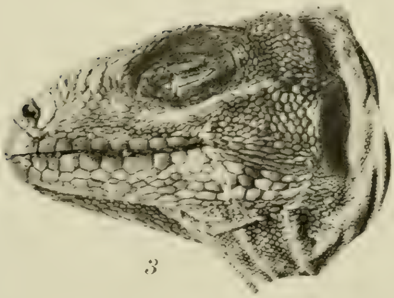

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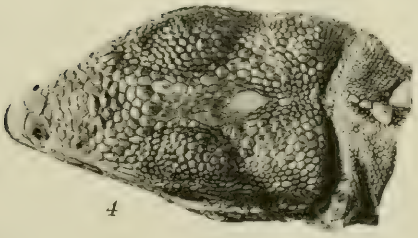

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GEORGE NELSON, PHOTO.

HELIOTYPE CO., BOSTON.

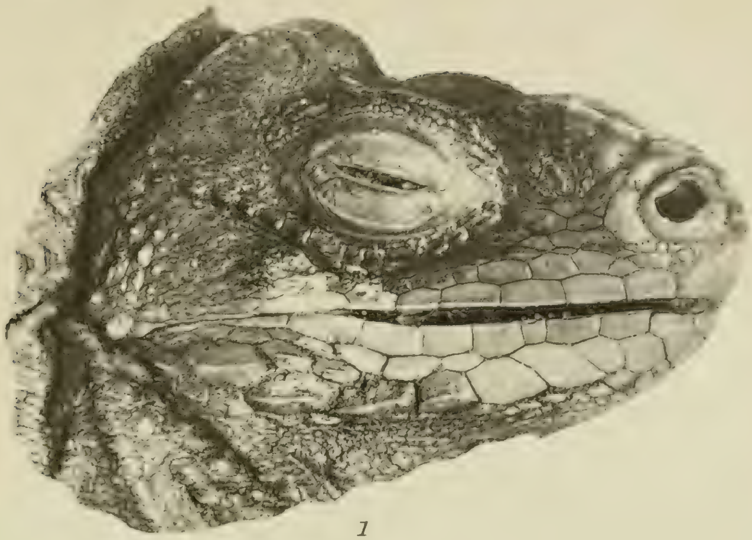
PLATE 9.

PLATE 9.

Cyclura collei Gray.

Fig. 1.— Side view of head of adult male. M. C. Z. 9397. Goat Island, near Old Harbour, Jamaica.

Fig. 2.— Upper view of head of the same specimen.



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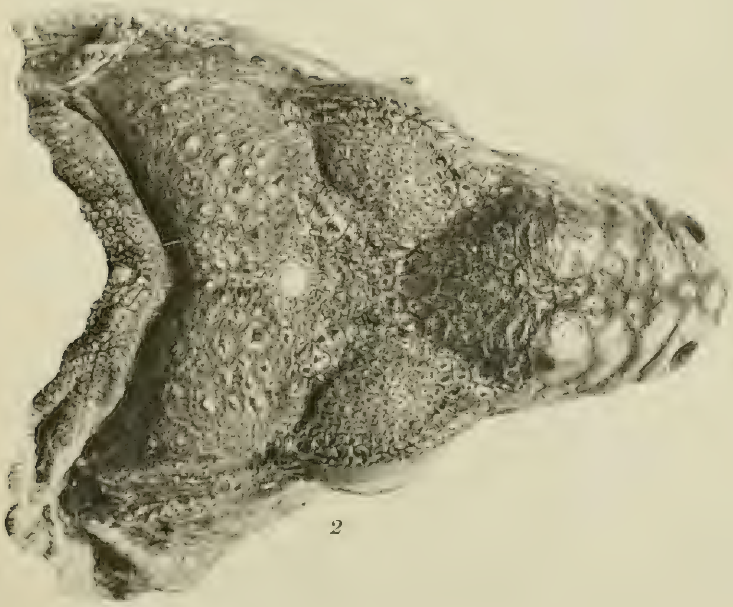

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GEORGE NELSON, PHOTO.

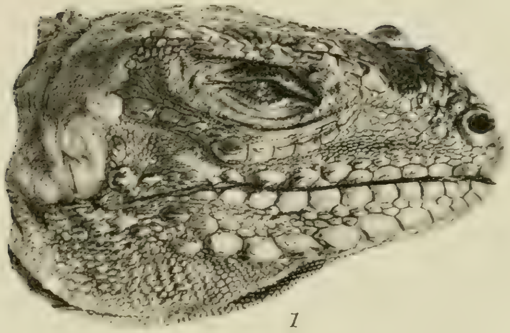
HELIOTYPE CO., BOSTON.

PLATE 10.

Cyclura cornuta (Bonnaterre).

Fig. 1.— Side view of head of half grown specimen. M. C. Z. 3597A. Jeremie, Haiti.

Fig. 2.— Upper view of head of the same specimen.



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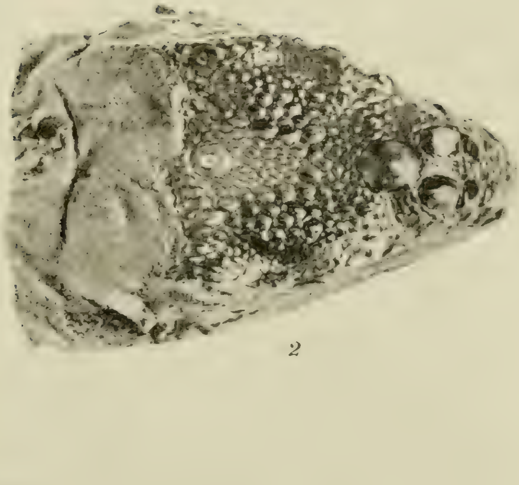

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GEORGE NELSON, PHOTO.

HELIOTYPE CO., BOSTON.

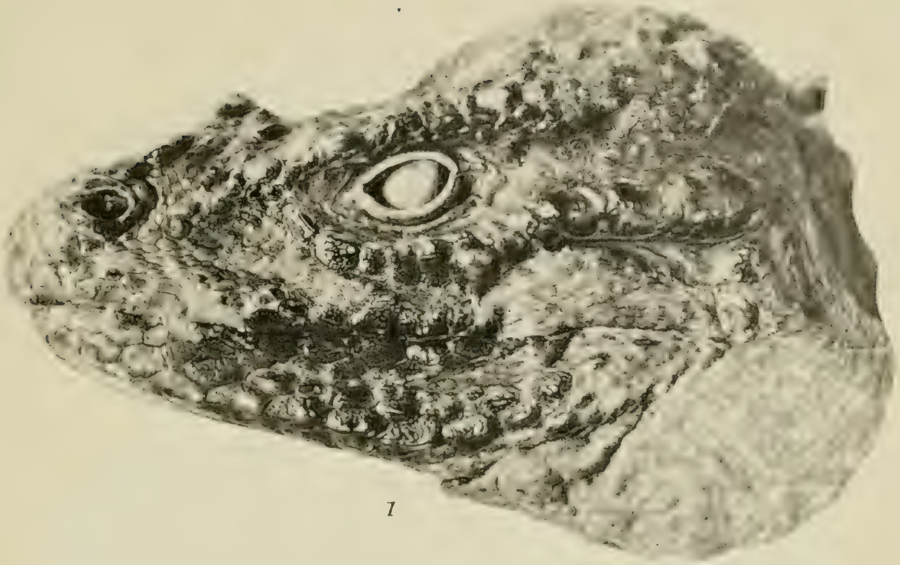
PLATE 11.

PLATE 11.

Cyclura nigerrima Cope.

Fig. 1.— Side view of head of adult male. Cotype? M. C. Z. 4717. Navassa Island.

Fig. 2.— Upper view of head of the same specimen.



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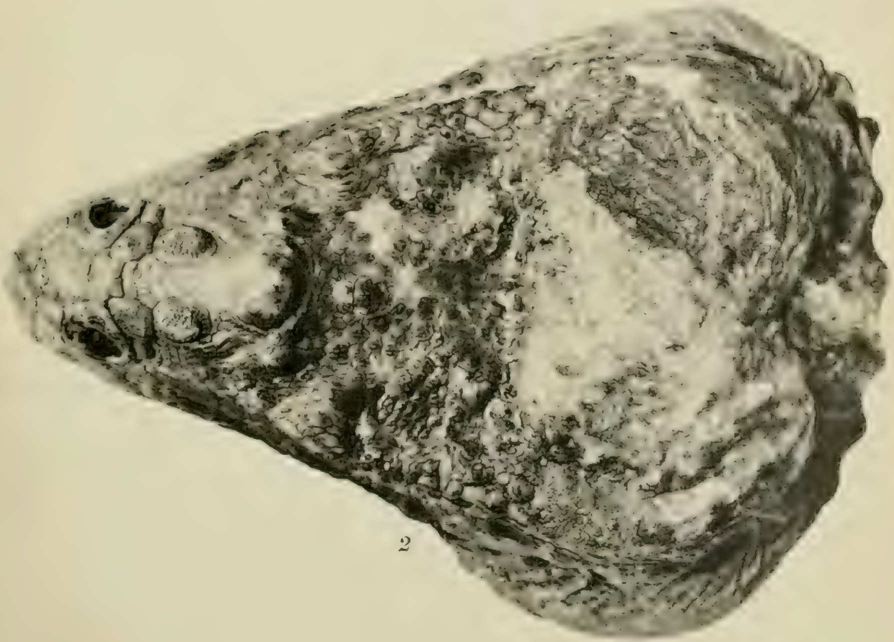

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GEORGE NELSON, PHOTO

HELIOTYPE CO., BOSTON.

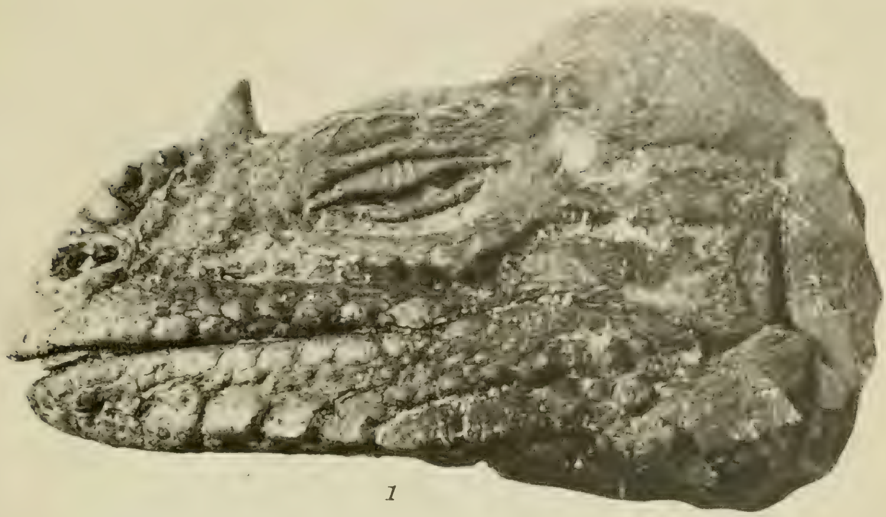
PLATE 12.

PLATE 12.

Cyclura stejnegeri Barbour & Noble.

Fig. 1.— Side view of head of adult male. Paratype M. C. Z. 11145. Mona Island.

Fig. 2.— Upper view of head of the same specimen.



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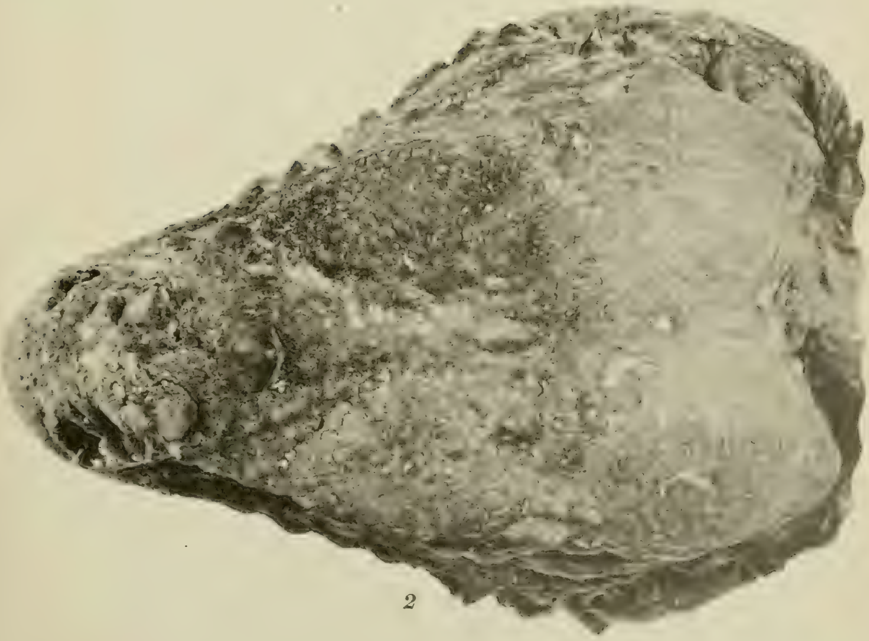

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GEORGE NELSON, PHOTO

HELIOTYPE CO., BOSTON.

PLATE 13.

PLATE **13**.

Cyclura baeolopha Cope.

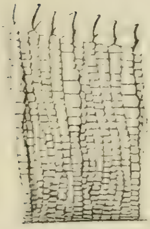
Fig. 1.— Segment of tail. M. C. Z. 5960. *Cf.* Plate **6**, fig. 1.
Fig. 2.— Foot of the same specimen.

Cyclura carinata Harlan.

Fig. 3.— Segment of tail. M. C. Z. 1252. *Cf.* Plate **8**, fig. 3.
Fig. 4.— Foot of the same specimen.

Cyclura macleayi Gray.

Fig. 5.— Segment of tail. M. C. Z. 11050. *Cf.* Plate **2**, fig. 1.
Fig. 6.— Foot of the same specimen.



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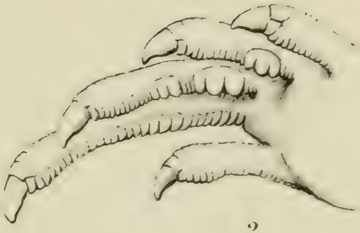

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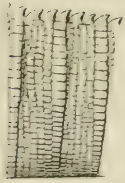

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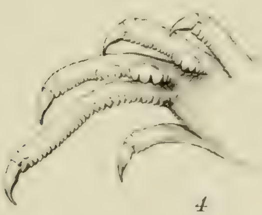

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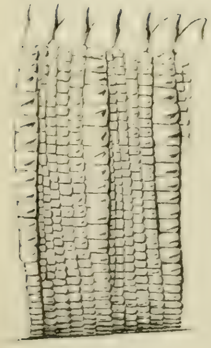

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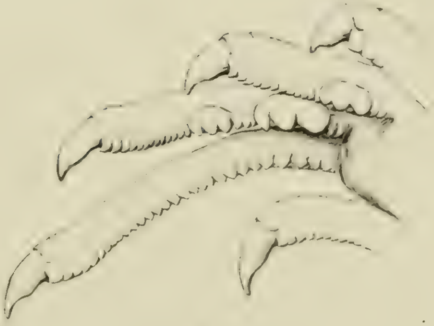

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E. N. FISCHER DEL.

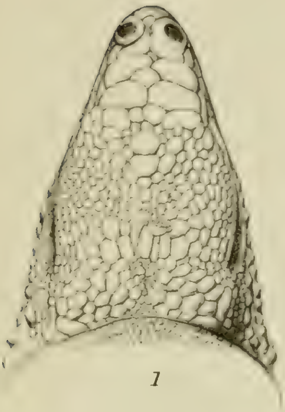
HELIOTYPE CO., BOSTON.

PLATE 14.

PLATE 14.

Cyclura inornata Barbour & Noble.

Fig. 1.— Upper view of head. Type M. C. Z. 11062. U Cay in Allen's Harbor, near Highborn Cay, Bahamas.
Fig. 2.— Side view of head of the same specimen.
Fig. 3.— Segment of tail of the same specimen.
Fig. 4.— Foot of the same specimen.



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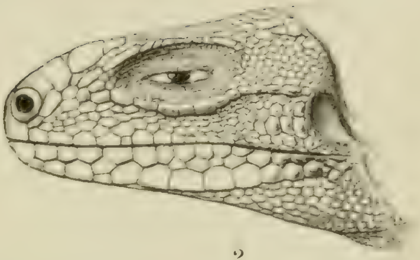

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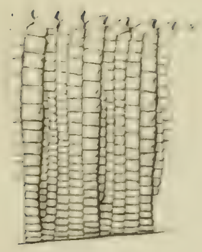

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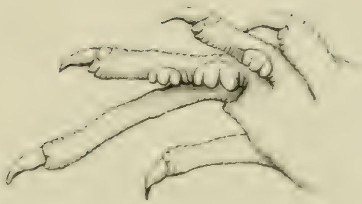

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E. N. FISCHER DEL.

HELIOTYPE CO., BOSTON.

PLATE 15.

PLATE **15**.

Cyclura nigerrima Cope.

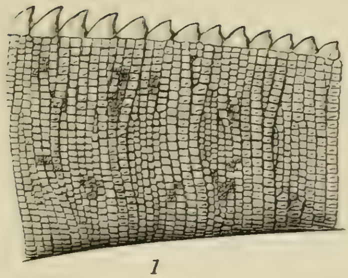
Fig. 1.— Segment of tail. M. C. Z. 4717. Navassa Island.
Fig. 2.— Foot of the same specimen.

Cyclura rileyi Stejneger.

Fig. 3.— Segment of tail. M. C. Z. 10918. Watlings Island.
Fig. 4.— Foot of the same specimen.

Cyclura collei Gray.

Fig. 5.— Segment of tail. M. C. Z. 9397. Goat Island, near Old Harbour, Jamaica.
Fig. 6.— Foot of the same specimen.



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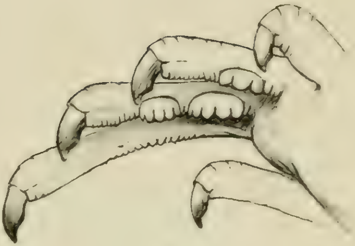

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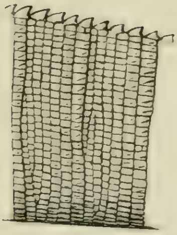

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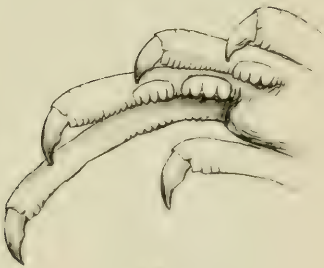

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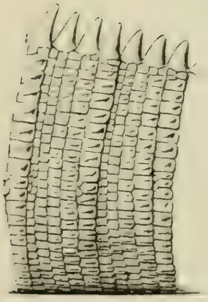

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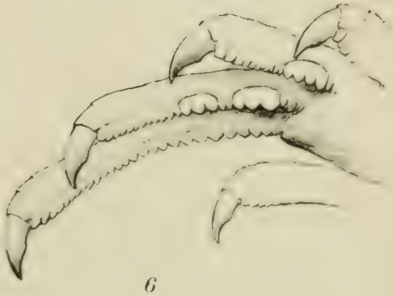

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E. N. FISCHER DEL.

HELIOTYPE CO., BOSTON.

Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. LX. No. 5.

THE ANTS OF THE PHILLIPS EXPEDITION TO PALESTINE DURING 1914.

By W. M. Wheeler and W. M. Mann.

CAMBRIDGE, MASS., U. S. A.:
PRINTED FOR THE MUSEUM.
February, 1916.

No. 5.— *The Ants of the Phillips Expedition to Palestine during 1914.*

CONTRIBUTIONS FROM THE ENTOMOLOGICAL LABORATORY OF THE BUSSEY INSTITUTION, HARVARD UNIVERSITY, NO. 107.

By W. M. Wheeler and W. M. Mann.

The junior author, while accompanying Dr. John C. Phillips on a recent zoölogical expedition to Palestine and the adjacent countries for the Museum of Comparative Zoölogy, succeeded in amassing quite a collection of ants. As many collections of these insects have been made from time to time in Egypt and Asia Minor and have been carefully described in numerous papers by Ern. André, Emery, Forel, Mayr, and Ruzsky, it seemed improbable that another collection would contain anything new. After the specimens were mounted and examined, however, we were surprised to find among them a new and peculiar species of Deromyrma and a few undescribed varieties and subspecies of well-known Mediterranean species. We decided, therefore, to publish a list of all the forms collected, together with such field-notes as seemed interesting.

Formicidæ.

1. *Ponera eduardi* Forel. ☿ ♀ (ergatoid).— Baniyas, Syria.
2. *Sima bifoveolata* Mayr var. *syriaca,* var. nov.

Worker. Agreeing very closely with the typical form described from Delagoa Bay and Zanzibar, except in the following characters: — the tibiæ have no suberect hairs, the mandibles have only three instead of four or five teeth, and the petiolar node is semicircular in profile. The tip of the gaster is not brown. The peculiar paired granular pits on the occiput seem to be quite as distinctly developed as in the type.

Several workers found running on plants at Wady Gazelle, Sinai Peninsula. The typical form has been recorded by Mayr only as far north as the White Nile where it was taken by Trägårdh.

3. *Aphaenogaster splendida* Roger. ☿ — Rasheya, Syria; in damp, shady places.

4. *Aphaenogaster* (*Deromyrma*) *phillipsi*, sp. nov. (Fig. 1).

Worker. Length 6–6.8 mm.

Very slender. Head twice as long as broad, with the rather small but convex eyes well in front of the middle of its sides; cheeks subparallel, distinctly convex, postocular borders of head straight and gradually converging to the occipital border, which has a strongly reflexed margin and is only about half as broad as the distance between the eyes. In profile the upper surface of the head is convex anteriorly, the gular surface flat. Mandibles with slightly concave external borders, three stout apical teeth and several basal denticles. Clypeus flat and subcarinate, the middle of its anterior border broadly and sinuately excised. Frontal area impressed, distinct, with a median carinula. Frontal carinae approximated and parallel behind. Antennae very slender, the scapes surpassing the occipital margin by about $\frac{2}{5}$ their length; funiculus without a club, its joints very slender, the second, third, and terminal longest. Thorax slender, pro- and mesonotum subequal, the former in profile feebly convex, the latter sloping, slightly concave in the middle and with a small but distinct convexity in front just behind the promesonotal suture. Mesoëpinotal constriction abrupt, short and moderately deep. Epinotum in profile about $1\frac{1}{2}$ times as long as high, its base convex in profile and twice as

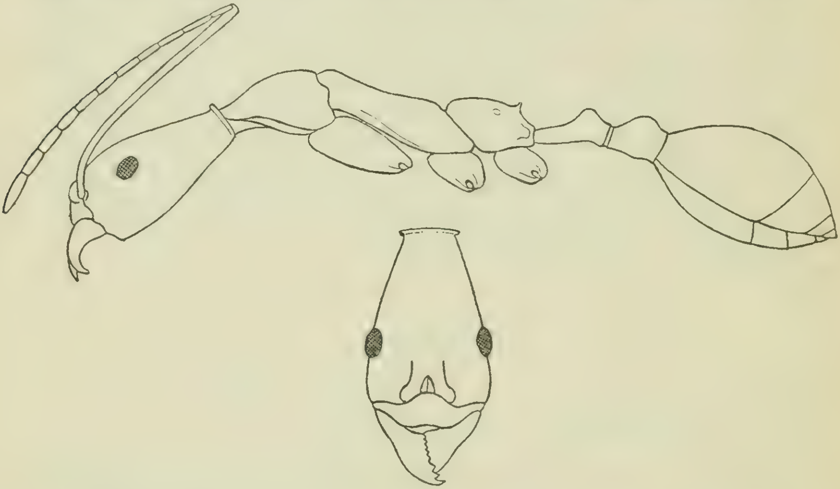

Fig. 1. *Aphaenogaster* (*Deromyrma*) *phillipsi*, sp. nov. Body of worker in profile; head of same from above.

long as the concave declivity, armed with two small, rather acute teeth, which are directed upward and slightly backward and outward. Petiole more than twice as long as broad, in profile with a rather low, rounded node. Postpetiole about $1\frac{1}{3}$ times as long as broad, less than half again as broad as the petiole, in profile with a similar but somewhat larger node. Gaster elongate elliptical, narrowed in front. Legs very long and slender; spurs of the posterior tibiae short but distinct.

Gaster very smooth and shining, remainder of body more feebly shining. Mandibles subopaque, finely and densely striate; head, thorax, petiole, and postpetiole shagreened, the meso- and epinotum opaque, rugulose-punctate; the anterior portion of the head above, including the antennal foveae and excluding the clypeus, longitudinally rugose, becoming reticulately rugulose and punctate posteriorly; pronotum and upper surfaces of petiolar and postpetiolar nodes smoother and more shining. Epinotal declivity shining, feebly and transversely rugose.

Hairs yellow, very short, blunt, sparse on the body, entirely lacking on the legs; very short, but distinct and oblique on the antennal scapes, especially towards their tips. Pubescence absent.

Head, thorax, petiole, postpetiole, and antennae pale ferruginous; legs brownish yellow; gaster clear, pale yellow, with the posterior $\frac{3}{5}$ of the first segment dark brown.

Described from eleven workers from Petra, Palestine. These were found in the early morning eating portions of the bait with which small mammal traps had been baited.

This species differs considerably from either of the two previously described Palaearctic species of Deromyrma, *cecconii* Emery from Crete and *rhaphidiiceps* Mayr from Turkestan. The Cretan species is smaller (5.7 mm.), has the body black, the tibiae with oblique hairs, the petiolar node is angular in profile, the epinotal teeth are longer, the head is shorter and of a different shape behind and the antennal funiculi have an indistinct, 4-jointed clava. In coloration and the shape of the head *phillipsi* resembles *rhaphidiiceps*, but the latter is smaller, the occipital margin of the head has no reflected margin, the clypeal border is entire, the first funicular joint is longer than the second and the tibiae are hairy.

5. *Messor rufotestaceus* Foerster. ☿.— Wady Gharandel, Sinai Peninsula and Petra, Palestine; in the former locality living in crater nests, in the latter under stones and more abundant.

6. *Messor barbarus* Linné subsp. *structor* Latr. var. *orientalis* Emery. ☿.— Rasheya, Ammik, and Baruk, Syria; Ain Gleidat and Wady Hisa, Palestine.
7. *Messor barbarus* Linné subsp. *semirufus* Ern. André. ☿.— Ammik, Hasbeiya, Zahleh, and Baniyas, Syria; Wady Hisa, Palestine. One of the commonest ants in Syria, in crater nests.
8. *Messor barbarus* Linné subsp. *semirufus* Ern. André var. *concolor* Emery. ☿.— Shiba, Syria; Fuweila, Arabia; Wady Feran, Sinai Peninsula; Wady Hisa, Palestine.
9. *Messor barbarus* Linné subsp. *meridionalis* Ern. André. ☿.— Petra and Wady Mojeb, Palestine; Shiba and Wady El Katana, Syria.
10. *Messor barbarus* Linné subsp. *aegyptiacus* Emery. ☿ ♀ ♂.— Wady Feran, Wady Gazelle and Mt. Sinai, Sinai Peninsula; Cairo (Mann) and Fayum (Wm. Granger), Egypt.
11. *Pheidole pallidula* Nyl. ♃ ☿.— Petra and Wady Kerak, Palestine; Ammik, Syria; Wady Feran and Wady Gazelle, Sinai Peninsula.
12. *Pheidole megacephala* Fabr. ♃ ☿.— Baruk, Syria.
13. *Pheidole sinaitica* Mayr. ♃ ☿.— Cairo, Egypt.
14. *Crematogaster scutellaris* Oliv. subsp. *schmitti* Mayr var. *ionia* Forel. ☿.— Rasheya, Syria; Petra, Palestine. We refer these specimens to Forel's variety on account of the distinct infuscation of the head and thorax.
15. *Crematogaster auberti* Emery subsp. *jehovae* Forel. ☿.— Wady Kerak and Ain Gleidat, Palestine; Shiba, Syria.
16. *Crematogaster auberti* Emery subsp. *antaris* Emery. ☿.— Mt. Sinai, Sinai Peninsula; Fuweila, Arabia.
17. *Crematogaster inermis* Mayr. ☿.— Mt. Sinai, Wady Gazelle, and Wady Feran, Sinai Peninsula; Wady Mojeb, Palestine. This is the commonest species of the genus in the Sinaitic Peninsula.
18. *Crematogaster lorteti* Forel. ☿.— Ain Gleidat, Palestine. Many colonies, nesting under stones in moist localities.
19. *Monomorium venustum* F. Smith subsp. *niloticum* Emery. ☿.— Wady Gazelle, Sinai Peninsula.
20. *Monomorium solomonis* Linné. ☿.— Fuweila, Arabia; Wady Gharandel, Sinai Peninsula; Wady Mojeb, Palestine.
21. *Monomorium solomonis* Linné subsp. *subopacum* F. Smith var. *phoenicia* Emery. ☿ ♀ ♂.— Akaba, Arabia; Petra, Palestine.
22. *Monomorium bicolor* Emery subsp. *nitidiventre* Emery. ☿ ♀.— Cairo, Egypt.

The female (deälated) measures 3.8–4 mm. and resembles the worker in color and sculpture, except that the base of the gaster above is yellowish red like the head, thorax, and pedicel and more opaque. Head longer than broad, with straight, subparallel sides, distinctly excised posterior border and rather angular posterior corners. Thorax elongate elliptical, fully 2½ times as long as broad; in profile the dorsal surface of the mesonotum, praescutellum and scutellum form a straight line; epinotum with a pronounced median longitudinal impression. Postpetiole not broader than the petiole, distinctly broader than long.

23. *Monomorium abeillei* Ern. André. ☿.— Wady Feran and Wady Gazelle, Sinai Peninsula; Petra, Palestine.
24. *Monomorium* (*Holcomyrmex*) *dentigerum* Roger. ☿.— Petra, Palestine.
25. *Monomorium* (*Holcomyrmex*) *dentigerum* Roger var. *baal*, var. nov.

Worker. Differing from the typical form in its decidedly darker color, the body and antennal scapes being castaneous or blackish brown; the discs of the mandibles, the clypeus, front, cheeks, mesonotum, pleurae, and lower portions of the petiole and postpetiole deep red; the legs and tips of antennal scapes yellowish brown.

Numerous specimens from Shiba, Syria and Wady Kerak, Palestine.

26. *Leptothorax tuberum* Fabr. var. *luteus* Forel.

Three workers from Ain Gleidat, Palestine agree closely with the description of this form except that they have the posterior half of the first gastric segment and the whole of the remaining segments pale brown instead of yellow, like the remainder of the body. We deem it inadvisable to describe this form as a new variety on the basis of so little material.

27. *Tetramorium striativentre* Mayr. ☿.— Wady El Katana, Syria; Wady Mojeb, Palestine.
28. *Tetramorium caespitum* Linné. ☿.— Petra, Palestine.
29. *Tetramorium caespitum* Linné var. *forte* Forel. ☿.— Baruk, Syria.
30. *Tetramorium caespitum* Linné var. *schmitti* Forel. ☿.— Baruk and Ammik, Syria; Wady Mojeb, Palestine; Mt. Sinai, Sinai Peninsula.

31. *Tetramorium caespitum* Linné subsp. *punicum* F. Smith var. *lucidulum* Emery. ☿.— Petra, Palestine; Ammik and Baniyas, Syria; Mt. Sinai, Sinai Peninsula. The colonies at Petra were very populous and were nesting under stones.
32. *Tetramorium caespitum* Linné subsp. *judas*, subsp. nov.

Worker. Length 2.3–3.5 mm.

Allied to the subspecies *semilaeve* Ern. André but the whole body, except the mandibles and clypeus, shining and the sculpture very feeble. Head much as in *semilaeve*, with the sides, posterior corners and a streak between the front and the posterior corners smooth and shining, the rugae on the front delicate and numerous, continued nearly or quite to the occiput. Pro- and mesonotum smooth and shining, with only traces of rugae at the sides, epinotum subopaque and rugose; pleurae more or less rugose as are also the sides of the petiole and postpetiole, the summits of the nodes of the latter shining, nearly smooth, or merely indistinctly punctate-rugulose. Gaster smooth and shining throughout. Color dark brown; mandibles, clypeus, cheeks, antennae, and legs testaceous.

Nine specimens from Wady Mojeb, Palestine.

This form seems to be near the var. *splendens* Ruzsky of the subsp. *semilaeve*, but we infer that the thorax is more strongly sculptured than the head in this form.

33. *Bothriomyrmex meridionalis* Roger var. *syria* Forel. ☿.— Ain Gleidat, Palestine; Rasheya and Wady El Katana, Syria; Wady Gazelle, Sinai Peninsula.
34. *Tapinoma erraticum* Latr. ☿.— Petra, Palestine; Baruk, Syria.
35. *Tapinoma erraticum* Latr. subsp. *nigerrimum* Nyl. ☿.— Petra, Palestine; Fuweila, Arabia.
37. *Acantholepis frauenfeldi* Mayr. ☿ ♀.— Wady Hisa, Palestine.
38. *Acantholepis frauenfeldi* Mayr var. *bipartita* F. Smith. ☿ ♀.— Rasheya and Wady El Katana, Syria.
39. *Acantholepis carbonaria* Emery. ☿.— Wady Gazelle, Sinai Peninsula.
40. *Acantholepis capensis* Mayr var. *canescens* Emery. ☿.— Two workers from Fuweila, Arabia agree very closely with a single specimen of this ant from Erythraea in the senior author's collection. This variety is also recorded from Kaka on the White Nile and from Bogosland and Somaliland.

41. *Plagiolepis pygmaea* Latr. ☿ ♀.— Ain Gleidat and Petra, Palestine; Ammik, Syria; Wady Feran, Sinai Peninsula.
42. *Prenolepis* (*Nylanderia*) *jaegerskjoeldi* Mayr. ☿.— Cairo, Egypt; Wady Kerak, Palestine.
43. *Formica rufibarbis* Fabr. var. *clarorufibarbis* Ruzsky. ☿.— Baruk, Syria. The specimens have the base of the gaster red as in the var. *clara* Forel, but the top of the head is infuscated as in the typical *rufibarbis*.
44. *Cataglyphis bombycina* Roger. ♃ ☿.— Lake Fayum, Egypt (Wm. Granger).
45. *Cataglyphis bombycina* Roger var. *sinaitica*, var. nov.

Soldier and Worker. Differing from the typical form in the much darker coloration, the occiput, thorax, petiole, gaster, and femora being deep castaneous brown or even blackish, the knees, tibiae, head, antennal scapes, and first funicular joint and in some specimens also the thoracic dorsum, paler brown; the mandibles in the worker yellowish red. Antennal funiculi beyond the first joint and the teeth of the mandibles black. The hairs on the tibiae are distinctly longer than in the typical form and the silver pubescence, especially on the gaster, is even denser.

A single soldier and numerous workers from Wady Gazelle, Sinai Peninsula.

46. *Cataglyphis albicans* Roger subsp. *livida* Ern. André. ☿ ♀.— Petra, Palestine; Wady Gharandel, Sinai.
47. *Cataglyphis viatica* Fabr. subsp. *bicolor* Ern. André. ☿.— Baruk and Ammik, Syria; Wady Mojeb, Palestine.
48. *Cataglyphis viatica* Fabr. subsp. *bicolor* Ern. André var. *nigra* Ern. André. ☿.— Cairo, Egypt; Lake Fayum, Egypt (Wm. Granger).
49. *Cataglyphis viatica* Fabr. subsp. *bicolor* Emery var. *orientalis* Forel. ☿.— Wady Mojeb and Wady Hisa, Palestine; El Katana, Syria; Wady Feran and Wady Gharandel, Sinai Peninsula.
50. *Cataglyphis cursor* Fonsc. subsp. *aenescens* Nyl. ☿.— Shiba, Syria.
51. *Camponotus* (*Myrmoturba*) *maculatus* Fabr. subsp. *thoracicus* Fabr. var. *oasium* Forel. ☿.— Ammik, Syria; Wady Feran, Sinai Peninsula.
52. *Camponotus* (*Myrmoturba*) *maculatus* Fabr. subsp. *thoracicus* Fabr. var. *cypriacus* Forel. ☿ ♀.— Wady Gharandel, Sinai Peninsula.

53. *Camponotus* (*Myrmoturba*) *maculatus* Fabr. subsp. *thoracicus* Fabr. var. *xerxes* Forel. ☿.— Zahleh, Syria.
54. *Camponotus* (*Myrmoturba*) *maculatus* Fabr. subsp. *thoracicus* Fabr. var. *sanctoides* Forel. ☿ — Wady Feran and Mt. Sinai, Sinai Peninsula.
55. *Camponotus* (*Myrmoturba*) *maculatus* Fabr. subsp. *thoracicus* Fabr. var. *mortis* Forel. ☿.— Wady Feran, Sinai Peninsula.
56. *Camponotus* (*Myrmoturba*) *maculatus* Fabr. subsp. *sanctus* Forel. ☿.— Shiba, Bakeyas, El Katana, and Rasheya, Syria; Petra, Palestine.
57. *Camponotus* (*Myrmoturba*) *maculatus* Fabr. subsp. *turkestanicus* Ern. André. ☿.— Wady Hisa, Palestine.
58. *Camponotus* (*Myrmoturba*) *maculatus* Fabr. subsp. *baldaccii* Emery. ☿.— Baniyas, Syria.
59. *Camponotus* (*Myrmoturba*) *maculatus* Fabr. subsp. *aethiops* Fabr. var. *concavus* Forel. ☿.— Shiba, Syria; Mt. Hermon, Palestine.
60. *Camponotus* (*Orthonotomyrmex*) *lateralis* Oliv. var. *atricolor* Nyl. ☿.— Rasheya and Ammik, Syria.
61. *Camponotus* (*Orthonotomyrmex*) *interjectus* Mayr. ☿.— Wady Kerak, Palestine.
62. *Polyrhachis* (*Myrmhopla*) *simplex* Mayr. ☿ ♀ ♂.— Wady Kerak, Palestine; Wady Feran, Sinai Peninsula.

This species was very abundant in both of these localities, always in damp places and always associated with a certain tree. In Wady Feran several nests were seen on plants. These were made of portions of leaves and twigs fastened together with films of silk. In Wady El Katana, near the Dead Sea, the only nest found was beneath a stone at the base of a tree. It contained many larvae, some of which were lying on the ground, and others on a sheet of silk. On nearly every tree in the vicinity of this nest there were many Membracidae which were constantly attended by the *Polyrhachis* workers and in most cases even sheltered in sheds constructed by the ants. The workers were observed while carrying the larvae up the trees and using them to spin the silk of the sheds.

Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. LX. No. 6.

RESULTS OF THE YALE PERUVIAN EXPEDITION OF 1911.
THE ARACHNIDA.

By Ralph V. Chamberlin.

With Twenty-five Plates.

CAMBRIDGE, MASS., U. S. A.:
PRINTED FOR THE MUSEUM.
March, 1916.

No. 6.— *Results of the Yale Peruvian Expedition of 1911.— The Arachnida.*

By Ralph V. Chamberlin.

The arachnids, upon a study of which this paper is based, were collected for the most part by Prof. H. W. Foote while a member of the Yale Peruvian Expedition of 1911. The collection has proved to be extraordinarily interesting, presenting a very large proportion of previously undescribed forms among which are eighty-two new species and twelve new genera. A few specimens were secured at Panama; but aside from these, the material all comes from localities in a little known section of southeastern Peru at elevations ranging from 3,000 to 11,500 feet above sea level. Comparatively few of the species seem to be identical with forms recorded from more northerly localities of Peru by Taczanowski in his Les Araneides du Peru (Bull. Soc. nat. Mosc. 1878, **53**, p. 278–374; Horae Soc. entom. Ross., 1878, **14**. p. 140–175; 1879, **15**, p. 102–136). Some of the localities mentioned are not on published maps.

This collection of arachnids was turned over to the author for study through the kindness of Professor Foote, who has also consented that the entire lot remain the property of the Museum of Comparative Zoölogy. Prof. A. Petrunkevitch of Yale had planned to report upon the collection but the press of other duties prevented. He had made notes and drawings of several species which were kindly sent to me.

The principal Peruvian localities from which the arachnids of the collection come with elevations and months during which specimens were secured are as follows: —

Arequipa,	7,600 feet	June
Cuzco,	11,500 feet	July
Huadquina,	5,000 feet	July
Ollantaytambo,	9,000 feet	July
Torontoy,	8,000 feet	July
San Miguel,	6,000 feet	July
Urubamba,	9,500 feet	July
Lucma,	7,000 feet	August
Paltaybamba,	5,000 feet	August

Santa Ana,	3,000 feet	August
Tincochaca,	7,000 feet	August
Vilcabamba,	10,000 feet	August
Conservidayo River,	——	August
Sorontoy,	7,000 feet	September

The specimens from Panama were collected in June.

SCORPIONIDA.

BUTHIDAE.

Tityus footei, sp. nov.

Plate 1, fig. 1–4.

Carapace and dorsum of preabdomen from testaceous to dark reddish with blackish markings near eyes and along the anterior border of the carapace, and especially across the caudal borders of the abdomen, the dark bands widest at middle. Legs and pedipalps yellowish. Cauda proximally from yellow to testaceous of reddish cast becoming decidedly darker distad, the last one or two segments usually black or nearly so; sting, in individuals in full color, more or less chestnut.

Carapace and all tergites of preabdomen strongly granular. Preabdominal sternites each roughened with minute granules. All segments of cauda granular, the fifth most strongly so. All tergites of preabdomen with median dorsal keel well developed, that of the fifth incomplete behind, and with two well-developed dorsal keels each side of it; sternite of fourth and fifth segments with five keels of which the median is very weak. First segment of cauda with ten keels, a complete median lateral ridge being present between the usual upper and lower lateral ridges; second segment with keels the same excepting that the median lateral is developed only caudad; third and fourth segments with the eight ridges, two median dorsal and median ventral and the two upper and two lower laterals; fifth segment with but five distinct keels, the odd one being a complete median ventral; all keels granular.

Basal portion of sting finely granular. A well-developed acute spine beneath, (Plate 1, fig. 1).

Legs and pedipalps with strongly developed longitudinal granular ridges.

Hand of pedipalp broader than tibia, its ridges strongly developed, these continuing upon the immovable finger where they become smooth. Finger with fifteen or sixteen oblique lines of granules, (Plate 1, fig. 2); not fully twice as long as proximal hand (cir. 7:4).

Comb with 20–22 teeth. Basal middle lamella enlarged, Plate 1, fig. 4.

Length of types 38 to 52 mm.

Cauda of male proportionately longer and more slender than in the female. (Fourth segment of cauda in female 2.5 mm. wide × 5.0 mm. long, in male 2.5 mm. wide × 5.8 mm. long).

Localities.— Huadquina, 5,000 feet, July 26. (Type, M. C. Z., 121; paratypes, M. C. Z. 122, five specimens.) Ollantaytambo 9,000 feet, July 20. (M. C. Z. 123, one young specimen).

Named for Prof. H. W. Foote of Yale University.

This species is apparently nearest to *T. bahiensis* (Perty). In coloration it differs in having the tibia of the pedipalp light and uniform, not conspicuously darkened in the way characteristic of *bahiensis*, and in having the fifth segment of the cauda conspicuously dark. The hand of the pedipalp is conspicuously more slender and its ridges are much more strongly developed and those along the immovable finger continue without break to the proximal end of the hand. The basal middle lamella of the comb is relatively much larger, being more inflated, and with its inner edge semicircular instead of straight. The spine on under side of sting is more slender and acute with at most only a single and relatively small granule on its upper edge.

BOTHRIURIDAE.

Brachistosternus andinus, sp. nov.

Plate 1, fig. 5–8.

General color yellow, the carapace and tergites of the preabdomen darkened with brown and blackish markings; carapace free from the darker color in a triangular area in front of eyes and in a narrower area behind them; tergites of preabdomen lighter along caudal border and in a narrow median longitudinal line; postabdomen above pale yellow, below darker, being mottled with brown which is most abundant on the fifth segment and is partially absent from the first.

Carapace and first six segments of the abdomen smooth and shining; seventh abdominal segment finely granular, (Plate **1**, fig. 5).

First segment of postabdomen equal in length and breadth, the second a little longer than wide. Dorsal and upper lateral keels of first segment of cauda finely granular, the granules on those of other segments fewer and weaker or essentially absent. Ventral median keel of cauda absent from first four segments, weakly developed on the fifth; lower lateral keels of fifth segment conspicuous, strongly granular, the lower lateral keels of the other segments obsolete. Ventral surface of the fifth segment conspicuously granular excepting at anterior end, that of the fourth segment with scattered granules, the venter elsewhere smooth.

Marginal keels of femur of pedipalp smooth; tibia along posterior ventral edge with trichobothria eight in number, these arranged in two rows of four each; hand of chela thicker than the tibia, smooth, with a row of 8–10 trichobothria under the outer ridge. The lateral granules on the mesal surface of the movable finger remaining apart and distinct from the main row over entire length, eight in number in each row, (Plate **1**, fig. 6).

The distal lamella of comb abruptly much narrower than the proximal ones so that the anterior edge appears indented at its beginning as in *B. ehrenbergi*. Teeth of each comb 28 in number, (Plate **1**, fig. 8).

Length 34 mm.

Locality.— Ollantaytambo 9,000 feet, July 20. (Type, M. C. Z. 124, one gravid female).

SOLPUGIDA

SOLPUGIDAE.

Mummucia variegata (Gervais).

Galeodes variegata Gervais, Gay Hist. Chile. Zool., 1849, **4**, p. 15, t. 1, f. 2.
Mummucia variegata Simon, Ann. Ent. soc. France, 1879, ser. 5, **9**, p. 151, t. 3, f. 29, 30.

Locality.— Ollantaytambo, 9,000 feet, July 20. (M. C. Z. 125, one female).

PHALANGIDA.

GONOLEPTIDAE.

GONOLEPTES ENOPLUS,[1] sp. nov.

Plate **2**, fig. 7–8; Plate **3**, fig. 1–5.

Main portion of carapace very dilute ferruginous, its caudal and caudolateral borders dusky but integument along edge of these parts white; area in front of cervical furrow deeply mottled with black; tergite of abdomen blackish with caudal border lighter. Legs black, but the distal articles of tarsus III conspicuously light, whitish, and the metatarsus and especially the tarsus of leg IV also somewhat lighter. Coxa IV dilute ferruginous black across distal end both below and above excepting the white line along the edge, its process also black excepting the paler tips. Coxae of legs I to III densely mottled with black excepting mesal ends which are paler. Sternites of abdomen blackish excepting the paler caudal borders and the white integument adjoining the caudal edges.

Body very wide toward caudal end of cephalothorax from where very strongly and abruptly narrowed cephalad to opposite bases of third legs, then more gently narrowing to anterior end; also conspicuously narrowing caudad to end of abdomen; the greatest width of carapace equal to body length, (Plate **2**, fig. 7).

Carapace with only four complete transverse sulci, but the first of these with two branches on each side; first sulcus lying in a deeper cervical furrow, as usual angularly bent caudad at middle; second sulcus moderately angularly bent forward at middle; third sulcus with ends bent abruptly caudad and then running subparallel with body axis; fourth sulcus angularly bent forward at middle; all sulci connected by a median longitudinal sulcus which is deepest between the first two. Eye-tubercle sharply set off and elevated, wider than long, the two cones near its caudal border not especially high. Anterior border of carapace conspicuously elevated as usual, the elevated rim much widest at middle. Lower frontal margin extended between the notches for mandibles and laterad of each in an acute spine-like process. Upper frontal margin at each lateral corner bearing several low teeth. Lateral border of carapace behind conspicuously elevated as usual, the ridge largely composed of a continuous row of tubercles which, large behind, decrease cephalad and disappear caudad of level of first sulcus, the row of tubercles continued also across caudal border. A row of two or three tubercles in a second low ridge occurs just mesad of the outer rim a little caudad of widest part of carapace. The cones, immediately in front of last sulcus and near middle line, are rather low, distally rounded. Area between last two sulci with numerous larger and smaller tubercles or granules, the area between the second and third with fewer and mostly very small granules and the area between the first and second with still fewer scattered and inconspicuous granules, (Plate **2**, fig. 7).

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[1] ἔνοπλος, armed.

First three tergites of abdomen with a continuous transverse row of conspicuous tubercles. Anal scutum without processes; rather obscurely granular.

First three pairs of coxae proximally parallel, the first two bending moderately cephalad from near middle of length, the third transverse for whole length; second coxae scarcely one fifth longer than the third; first coxae along midventral surface with a row of distinct granules, the second with a few almost obsolete granules and the third smooth. Fourth coxae very strongly enlarged and directed ectocaudad as usual; terminating on dorsoectal side in a stout process which has a shorter prong on the ventral side beyond middle of length; on mesal side of distal end with a shorter stout process which is toothed on its ectal side.

Spiracles moderate, distinct.

First article of mandibles strongly narrowed toward base; distal half with a strongly and abruptly elevated hump on dorsal surface. Distal article with fewer hairs in front and distad, (Plate **2**, fig. 8).

Pedipalps when extended shorter than carapace; not crossed. Trochanter roundly elevated and smooth above; ventrally with a single conical tubercle bearing distally a bristle. Femur a little complanate beneath and bearing few low granules from which hairs arise; dorsally also with scattered low granule-like elevations at bases of some of hairs. Patella smooth. Tibia not compressed; along mesoventral edge with two similar but stouter spines with proximal portions thicker as usual. Tarsus along mesoventral edge with two subequal spines of usual type and along ectoventral edge with two similar large spines and between these a much smaller spine and a similar one between the distal large spine and the base of the claw. Claw much shorter than tarsus, conspicuously curved, (Plate **3**, fig. 1, 2).

Femora of first two pairs of legs finely and conspicuously granular; femora of third legs more coarsely granular, the granules on ventral surface toward distal end largest; patella with a few granules; tibia with finer granules above but ventrally with larger distinct tubercles or teeth. Fourth leg with metatarsi abruptly more slender than tibia; trochanter IV on dorsoectal surface toward base with a stout, distally truncate process and on opposite side with two larger, distally acuminate processes; femur conspicuously curving dorsomesad, with numerous stout processes of differing lengths of which one from the dorsal surface, one opposite on ventral surface and one toward distal end from mesoventral surface are much the largest (Plate **3**, fig. 4, 5); patella with numerous small seriate tubercles of uniform size; tibia above and laterally with setigerous tubercles like those of patella but ventrally with a median-longitudinal series of 7–9 long processes which decrease in length distad; metatarsus with a series of low setigerous tubercles.

Tarsus I with five joints of which three are in the distal division; II with eight joints of which three are in the distal division; III with five joints of which the most distal is greatly enlarged and bears a setigerous process on its anterior end projecting between the claws, the ventral surface of articles densely clothed with short fine hairs, (Plate **3**, fig. 3); IV with six joints.

Length 8 mm.; greatest width of carapace also 8 mm.

Length of leg I 11 mm.; of leg II 20 mm.; of leg III 16 mm.; of leg IV cir. 21+ mm.

Locality.— San Miguel, 6,000 feet, July 24. (Type, M. C. Z. 126, one male).

GONOLEPTES HUADQUINAE, sp. nov.

Plate **4**, fig. 3–8.

General color above brownish grey, the head region darker and the anal scutum blackish; a series of lighter circular spots across dorsum of carapace and abdomen, one over and about each tubercle. Coxae of first three pairs of legs beneath black, the coxae of the fourth pair subtestaceous. Sternite of abdomen blackish with lighter transverse borders and spots. Trochanters of legs above and below brownish yellow; other joints of legs blackish but femora IV testaceous with fewer dusky mottlings; femora I to III paler at distal end with an obscure narrow light annulus near middle; tibiae all with an obscure median pale annulus; metatarsi also with faint median annulus and metatarsi III and IV with a more distinct light ring at distal end; tarsi III and IV with distal article pale and also with a submedian pale annulus.

Carapace broadest at level of third sulcus from where the body narrows conspicuously caudad, the comparatively long abdomen being more abruptly narrowed or constricted at third segment with the anal scutum narrowly rounded; cephalad the cephalothorax is abruptly narrowed near level of third legs as usual and a little indented on each side caudad of anterior end.

Carapace with the usual four sulci of which the first is bent back angularly at middle and the second is more moderately angulate in the opposite direction; the third sulcus is also weakly angulate and the fourth more strongly and acutely so between bases of the cones; a distinct median longitudinal sulcus between the first and the second sulci. Eye-tubercle distinctly limited, moderate in height, much wider than long; paired interocular processes close together, distinct, conically acuminate, pale in color. Tubercles along lateral submarginal elevated rims smaller and more obscure, these, as usual, becoming larger but of only moderate size caudad, the tubercles widely separated, those across caudal border similar. A pair of widely separated tubercles between eye-tubercle and first sulcus. Area between sulci I and II with a few low tubercles; the second area with an irregular transverse row of more distinct setigerous tubercles and the tubercles of the last area more numerous as usual. Conical processes of carapace moderate in size, acutely acuminate with an acute curved branch on subdorsal side, (Plate **4**, fig. 6, 7). Anterior border of head elevated as usual, being limited caudad by a transverse furrow as in other species. Frontal margin not dentate.

First three tergites of abdomen each with a transverse row of tubercles which decrease in size laterad and which are well separated. Anal tergite with a transverse row of four tubercles. Sternites of abdomen with corresponding rows of smaller tubercles.

Coxae I distally bent rather strongly forwards, the second more moderately so, the third straight and a little shorter than the second; coxae I to III inclusive each with a row of distinct tubercles along the midventral line. Coxae IV of the usual general form; tuberculate; the tubercles moderate, numerous but not dense; at distal end on mesal side with a proximally stout but not long process which distad is abruptly narrowed and terminates in an acicular point; on ectal side of distal end a shorter conical process.

Spiracles conspicuously exposed.

First article of mandible strongly constricted as usual with the article abruptly expanded distad of the constriction and with the dorsal hump conspicuous. Second article long, moderately curved ventrad at middle, the dorsal (anterior) face being somewhat depressed or excavated and bearing a moderate number of short stiff hairs. Fingers of chela crossing at tips, the outer one stouter, longer and more strongly bent at tip, (Plate **4**, fig. 3).

Pedipalps in type about as long as body, but in a second specimen in which the abdomen is strongly retracted they are considerably longer. Coxa strongly elevated above, the ventral process long and subcylindrical, white in color. Trochanter constricted proximally; at distal end on ventral surface a large conical tubercle. Femur subcylindrical, a few inconspicuous tubercles along ventral surface. Patella unarmed. Tibia along mesoventral line with two long curved spinous processes and two very small ones between the two large and in front of the distal one respectively; along ectoventral line with two long less curved processes of which the anterior is the larger and near the base of the latter and distad of it a very much reduced spine. Tarsus in mesoventral line with two long processes and along ectoventral line with two large processes and a third smaller process on ectal side between the others and in a second specimen with a small spine in front of others on ectal as well as mesal side. Claw much longer than the tarsus, (Plate **4**, fig. 4, 5).

Legs I to III with femora, patellae, tibiae, and metatarsi tuberculate, more strongly developed on femora than on more distal joints and more conspicuously ventrally than dorsally. Fourth legs with tubercles of femora largely replaced by more conspicuous conical processes; tubercles of other joints also stronger than on other legs Tarsus I of five segments, of which three are in the second division; II with eight, also with three in the second division; III with four (the most proximal with two false sutures thus giving appearance of seven articles), these densely clothed ventrally with fine short hairs as usual, none of the articles modified specially. Leg IV, (Plate **4**, fig. 8).

Length 5.6 mm.; greatest width of carapace 4 mm.

Length of leg I cir. 8 mm.; of leg II, 14 mm.; of leg III, 11 mm.; of leg IV, 14 mm.

Locality.— Huadquina, 5,000 feet, July 24. (Type, M. C. Z. 127, one female). San Miguel, 6,000 feet, July. (Paratype, M. C. Z. 128, one female).

GONOLEPTES SCOTIUS,[1] sp. nov.

Plate **3**, fig. 6–8; Plate **4**, fig. 1–2.

Body throughout black of brownish cast, lines of white along carapace caudally and laterally and bordering tergites and sternites of abdomen. Caudal edges of coxae IV also bordered with white. Carapace under lens seen to be not densely mottled with small lighter spots in head region and over border behind. The legs similarly mottled but light spots more numerous, the trochanters of all legs and the tarsi of third and fourth legs and in some also of first and second lighter in color. Palpi paler than legs, the spots being larger and in part confluent.

Body relatively narrower than in *enoplus*, the greatest width of carapace being much less than the total length of body and about equal to length of carapace. The general form of body shown in Plate **3**, fig. 6.

Carapace with four transverse sulci of which the first is deeper and is angulate at middle in the usual way, bifurcate on each side toward end; second sulcus angularly bent forwards at middle, the third toward each end bending back caudoectad; a strongly impressed longitudinal median sulcus between first and second transverse sulci which is more weakly continued between second and third and third and fourth. A transverse sulcus also indicated in line with caudal edge of eye-tubercle. Eye-tubercle sharply defined, moderate in height, wider than long, bearing a few small but distinct tubercles with paired ones present in place of the cones of *enoplus* rounded or boss-like, these two smaller than eyes but larger than other tubercles. Median portion of head just in front of eye-tubercle elevated and the anterior border each side of this part elevated as usual. Lower frontal margin excavated for mandibles as usual; upper frontal margin without distinct teeth at each rounded lateral corner but with rounded boss at end of ridge there. From cervical region caudad on each lateral border of carapace the usual series of tubercles; a tubercle-free area opposite the third sulcus and behind this about three noncontiguous larger tubercles and then along caudal margin a series of smaller tubercles which are widely separated and irregularly spaced. The conical processes at posterior end of carapace long, acuminate, close together. Dorsal area of carapace between first and fourth transverse sulci with scattered small granules.

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[1] σκότιος, dusky.

The three anterior tergites of abdomen each with a transverse row of well-separated conical tubercles which decrease in size from the middle ones laterad. Anal tergite caudally rounded, with two rounded elevations near base.

First two pairs of coxae curving a little forwards, the third straight throughout its length; second coxae a little longer than the third; first coxae with the usual row of setigerous tubercles which are very small; the second and third coxae smooth or nearly so. Fourth coxae greatly enlarged in the usual way; ending distally on the ectodorsal side in a large curved process which is unbranched, and on opposite side in a shorter one which presents a low rounded process on ectal side below tip. Coxae all with numerous small granules each bearing a hair. Spiracles distinctly exposed.

First joint of mandibles immediately distad of its constriction with an abruptly elevated rounded hump. Second joint with a few hairs in front toward distal end.

Trochanter of pedipalp with a rounded hump above and a single setigerous conical tubercle below. Femur subcylindrical; along ventral median line between base and middle three large conical tubercles. Patella unarmed. Tibia along mesoventral line with two spinous processes of which the anterior is much more slender and along the ectoventral line with two spinous processes of which the anterior is the larger, and in front of the latter a third much smaller spine. Tarsus along ectoventral line with five spines of which the first from caudal end and the third and fourth are larger; three spines in mesoventral line; claw large, as long or somewhat longer than the article (Plate 4, fig. 2).

Femora of first three pairs of legs granulotubercular ventrally, the tubercles of the third pair largest; tibiae of these legs also tubercular, the tubercles small, those of the ventral surface and especially those of the third pair largest; metatarsi more obscurely granular. Trochanter of leg IV granular; on inner side with a rounded process and on outer side with a much longer acuminate process which curves back caudad above base; femur tubercular and distad with a number of larger processes of which two much exceeding the others in size arise from the ventral surface toward the distal end and distally curve mesad; patella uniformly seriately tubercular; tibia with numerous tubercles which are larger, subconical, on ventral surface; metatarsus over proximal half with numerous tubercles, the distal, clavately enlarging half nearly smooth, (Plate **4**, fig. 1). Tarsus I with five segments; II with six articles of which three are in the second division; III with six which are clothed ventrally with numerous fine hairs and none of which is specially enlarged, but the metatarsus is greatly enlarged toward its distal end which is abruptly narrowed and resembles a tarsal article in form and pubescence, while from the ventral surface toward proximal end arises a very large, abruptly curved branch or process, (Plate **3**, fig. 8).

Length of type 7.8 mm.; greatest width of carapace 6.1 mm.

Length of leg I cir. 9 mm.; of leg II, 16 mm.; of leg III, 12+ mm.; of leg IV cir. 17 mm.

Locality.— Lucma, 7,000 feet, August 7. (Type, M. C. Z. 129, one male; paratypes, 130, two males).

Pachylus orinus,[1] sp. nov.

Plate **5**, fig. 1–3.

Body strongly narrowed cephalad; conspicuously constricted both laterally and dorsally along first furrow just back of eye-region and nearly in line with coxae of third legs; widest a little back of constriction where the sides are convexly rounded and from where the body narrows caudad to end of abdomen with no constriction between cephalothorax and abdomen; abdomen caudally semicircularly rounded.

Carapace with five transverse sulci of which the most anterior lies in the previously mentioned constriction and at its middle is bent caudad at a distinct angle; the second one forms a slight angle at middle with apex cephalad, while the other sulci are straight; no connecting longitudinal median sulcus excepting a very weak one between the first and second. Eye-tubercle sharply set off, about equal in length and breadth; the cone between eyes high and acute; eye-tubercle separated by a transverse furrow or depression from the conspicuously elevated frontal border. Lower frontal margin deeply notched or excavated for insertion of mandibles and between the two notches extending ventrad in a spiniform process, otherwise unarmed; unarmed above. Carapace with lateral borders strongly elevated, the marginal ridge over its middle, ectally curving portion conspicuously granular, the end portions smooth; caudal border with a transverse row of tubercles; the area between fifth and fourth sulci with a transverse row of fewer and less developed tubercles, the two areas next cephalad with still fewer and more obscure tubercles similarly in a transverse line, (Plate 5, fig. 1).

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[1] *’ορεινός*, a mountaineer.

The first two abdominal segments each bearing above a transverse row of numerous, well-developed granules. Dorsal anal scutum bearing five conspicuous spinous processes of which the median is much longest, and in front of the most anterior of these on each side a series of much smaller teeth which decrease progressively cephalad; the second spine from the median one on each side is elevated dorsally along its whole length in a keel-like form, the elevated portion projecting cephalad over base in a rounded, tubercle-like process.

First three pairs of coxae proximally parallel, those of the first two pairs distally curved considerably cephalad, the third ones straight throughout. Second coxae but little more than one fifth longer than the third (15:11). The coxae of the second and third pairs along anteroventral surface with a low, sharply elevated edge which is obscurely tuberculate; first coxae with no elevated edge but with a row of very small tubercles. Fourth coxae very strongly enlarged as usual and directed caudad; each one terminating at distal end on ectal side above in a stout acute spine and on opposite mesal side of end in a similar but smaller spine; elsewhere smooth, not tuberculate or dentate.

Spiracles distinct, rather large.

Mandibles stout; first article strongly narrowed proximally, the expanded distal portion with a strongly elevated, long, keel-like hump above which is smooth; second article in front sparsely clothed with hairs and with fewer hairs behind toward distal end, (Plate 5, fig. 2).

Pedipalps rather short, when extended scarcely as long as carapace; not crossed. Trochanter short, subcylindrical, with a low hump above on which are one or two slight tubercles; ventrally with a few hairs springing from slightly tubercular bases. Femur cylindrical, not compressed, moderately convexly elevated from end to end above; wholly without spines; a few short hairs from slightly tubercular bases below. Patella unarmed. Tibia not compressed; along mesoventral edge with two rather slender, acutely acuminate spines and between these a minute third one; along ectoventral edge with three long spines and between the caudal and middle one of these a fourth minute one; the middle one of the larger spines much largest and a little surpassing the distal end of tarsus when joints are flexed, the other two spines proximally abruptly thicker than distad, anterior spine cognate to base of large spine. Tarsus on mesal side ventrally with a series of four slender, distally bristle-like spines; on ectal side with a series of about twelve pale slender spines which are very short excepting two which are much larger and of about same size as the three of mesal side; tarsal claw of about same length as tarsus, (Plate **5**, fig. 3).

First three pairs of legs with femora, patellae, and tibiae especially on ventral surface finely but rather sparsely tubercular, a hair arising from each tubercle, distal joints wholly smooth. Fourth legs stout, with tarsi abruptly much more slender than the metatarsi; trochanter with two robust granules on ectal side and at distal end on mesal side with a stout thorn; femur granular above, along ventroectal edge with a series of mostly stout conical spines which, beginning at about one fourth the length from the proximal end as low tubercles increase regularly in length distad; along mesoventral surface a series of fewer and lower conical tubercles and on the mesal surface with two or three irregular series of conical tubercles and spines; patella strongly tubercular above and laterally, and with tubercles replaced by stout conical spines of which three or four are comparable in length to the larger ones of femur; tibia above and laterally strongly tubercular, below with tubercles replaced by stouter conical tubercular elevations and longer spines like those of the proximal joints; metatarsus above and laterally densely granular, below with stouter seriate cones or teeth, much smaller and more uniform than the spines of the proximal joints. Tarsus I with five joints, three of which are in the distal division; tarsus II with eight joints; III and IV with six joints.

General color dilute ferruginous, the head region weakly dusky; caudal border of carapace and the first two tergites of abdomen black; patellae and distal ends of femora and tibiae of legs dusky or black, the fourth legs a darker, more strictly ferruginous cast than the others. Abdomen darker beneath than coxae of legs.

Length to base of median caudal spine 10.2 mm.; to tip of caudal spine 12.3 mm. Greatest width of carapace 6 mm.

Length of leg I, (exclusive of coxa) *cir.* 15 mm.; of leg II, 22 mm.; of leg III, 7 mm.; of leg IV, 30 mm.

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 131). San Miguel, 6,000 feet, July. (Paratype, M. C. Z. 132, one specimen).

COSMETIDAE.

Paravanones peruvianus, sp. nov.

Plate 2, fig. 1–6.

General background of body a dilute ferruginous. Carapace dusky from a close network of black lines, the color less dusky in a deltoid area back of eye-tubercle with apex caudad and embracing two short black stripes, one caudad of each eye, in a narrow mid-longitudinal line, and along the transverse sutures and in a broader area along each side of the carapace, tubercles pale. Ventral surface of cephalothorax and coxae paler, a clearer light ferruginous; under lens seen to be covered with a less dense network of dark lines. Abdominal segments both above and below black or nearly so, a line back of each segment white. Legs also with an inconspicuous network of fine dark lines; femora, patellae, and tibiae dark at distal ends and tarsus of leg I also blackish.

Carapace widest at level of third sulcus, convexly rounded, abruptly narrowed a little in front of caudal end and at level of caudal edge of third legs in front of which the sides converge but moderately, the anterior corners more oblique.

Carapace crossed by five transverse furrows which are wide, not suture like, and of which the first is bent back angularly at the middle. Eye-tubercle much wider than long, concavely depressed from ends toward middle; a series of four tubercles in a curved line on each elevated end subparallel with edge of ocellus and several weaker tubercles immediately mesad of these; the median portion of eye-tubercle smooth. Anterior margin not elevated or only obscurely so on each side, the median portion between eye-tubercle and front margin broadly elevated. At each anterolateral corner a prominent process, (Plate 2, fig. 3), the border near level of anterior edge of second coxae with a process projecting caudoventrad and meeting a process from second coxae. Edges of carapace in its widest part with a number of rather low conical tubercles, the tubercles across caudal border more numerous and with two much larger subcylindrical processes near middle; the more anterior lateral margins essentially smooth. On areas between furrows a limited number of tubercles which are larger and somewhat more numerous in caudal than in anterior region, and in each area a pair of tubercles which are higher and more cylindric than the others; surface of carapace in general granulate, (Plate **2**, fig. 3).

A row of conical tubercles across each abdominal segment. Anal scutum proximally with smaller granules and tubercles, distally with a number of larger tubercles, about five of which appear as dentations on the caudal margin, one at middle and two or three on each side of it.

First coxae bent forwards at ends, the second slightly so. Third coxae but little shorter than the second. Coxa I in both male and female on caudal side above middle with two conical processes and at distal end on caudoventral corner with a longer process which is bent dorsad; along its anteroventral surface a row of tubercles the most distal of which appears at the anteroventral corner as a freely projecting larger conical process; from anterior surface at distal end a long cylindrical process which bends dorsad close to surface and overlaps the end of a process springing from anterodorsal surface. A low broad process from distal end of coxa II near anterodorsal corner; a row of a few tubercles along anteroventral line and a similar one on third coxae. Coxa IV at distal end on mesal side with a low rounded process, (Plate **2**, fig. 4–6).

Spiracles clearly exposed.

First joint of mandible strongly elevated above distad of the constriction; with a transverse row of caudally projecting teeth or conical tubercles across upper border of caudal surface of the dorsal hump; dorsal surface of hump with fine teeth or granules; second article rather short and broad with a few hairs at distal end below (caudad) and more in front, (Plate **2**, fig. 1).

Pedipalps short, closely flexed ventrad and caudad, not crossed. Coxa subcylindric. Trochanter narrow at base, expanding distad, with a broad conical projection beneath. Femur strongly flattened from side to side, being abruptly very high immediately distad of the narrow base; a row of teeth along the middorsal line and a series of longer subcylindric, distally rounded processes along ventral line. Patella of usual form; bearing small setigerous tubercles above. Tibia strongly flattened from side to side, especially on ventral half, clavately increasing in height from base distad; with a number of small tubercles on dorsal surface proximad. Tarsus subcylindric, with a low thin keel from ventral surface at proximal end, (Plate **2**, fig. 2).

Femora, patellae, and tibiae of legs I to III finely tubercular or granular, the metatarsi more abruptly so proximally and especially on legs III. Leg IV in female similar to leg III; in male with a series of much stronger teeth along dorsal or mesodorsal line and on ventral surface at distal end with a series of five conspicuous long processes of which the second is longest and is bent at distal end, the others being straight and decreasing in length distad; the patella with a stout spine above at proximal end. Tarsus I with five segments; II with thirteen segments; III with six segments, of which the last three are abruptly more slender; IV with seven segments of which three are in the second division; tarsi III and IV clothed with fine hair on ventral surface.

Length of male type 6 mm.; greatest width of carapace, 4.5 mm.; length of leg I cir. 1 mm.; of leg II, 21.5 mm.; of leg III, 13 mm.; of leg IV, 8 mm.

Length of female paratype 6 mm.; greatest width of carapace 4.5 mm.; length of leg I, 10.5 mm.; of leg II, 20 mm.; of leg III, 14 mm.; of leg IV, 18 mm.

Localities.— Santa Ana, 3,000 feet, August 4. (Type, M. C. Z. 133, male; paratype, M. C. Z. 34, female). San Miguel, 6,000 feet, July. (M. C. Z. 135, one female).

PHALANGIIDAE.

Liobunum monticola, sp. nov.

Plate **5**, fig. 9; Plate **6**, fig. 1–3.

Body above brown, a paler longitudinal median stripe which narrows to a point at caudal end of abdomen, this stripe on anterior portion of abdomen embracing a deep black, sharply defined median stripe. Eye-tubercle black. Ventral surface of body yellowish. Trochanters all deep black and coxae dusky distad; patellae also solid black and tibiae black at distal ends.

Body bluntly rounded behind, the abdomen broadest across caudal end; carapace narrowed markedly cephalad. Entire surface of body above and below densely granular, the granules conically acutely pointed. Abdomen clearly set off from cephalothorax by a suture; the two segments at end distinct.

Eye-tubercle high, its anterior and posterior faces subvertical or a little constricted at base; a curving line of acute spinous points mesad of each ocellus and curving caudoectad and ventrad on the caudal surface of tubercle, (Plate 6, fig. 1).

First joint of mandible nearly smooth, a little roughened over dorsal surface; hairs above few and straight, more on mesal surface. Second joint also smooth except for a light dorsal roughening; with a few longer hairs at distal end above and laterally with a more numerous patch on mesal side distad, (Plate 6, fig. 2, 3).

Pedipalps moderately long. Femur ventrally along ectal and similarly along mesal side with a row of acute teeth; also with a patch of teeth above and laterally at distal end. Dorsoectal and dorsomesal surfaces of patella with fine teeth which are largest and most numerous on the dorsomesal process, a narrow dorsal stripe free from teeth or nearly so. Tibia with teeth ventrally and especially laterally and dorsolaterally, a middorsal stripe free from teeth. The long slender tarsus free from teeth but with numerous short fine and a few coarser short hairs.

Legs with numerous fine teeth which become smaller and less conspicuous in going distad.

Length of body 3.8 mm. Length of palp cir. 4.5 mm.; of leg I, 32.5 mm.; of leg II, cir. 80 mm.; of leg III, 41 mm.; of leg IV, 51.5 mm.

Localities.— Paltaybamba, 5,000 feet, August 27. (Type, M. C. Z. 136). Santa Ana, 3,000 feet, August 3. (Paratype, M. C. Z. 137, one specimen).

Liopagus,[1] gen. nov.

Eye-tubercle weakly longitudinally furrowed; wholly smooth, bearing no teeth or spines or other processes.

Body essentially smooth.

Scutum unarmed.

First joint of mandible at base with the usual ventral process.

Patella of pedipalp with a moderate inner apophysis. Claw distinctly pectinate.

A one pointed process on dorsal margin of distal end of all coxae. Legs thin; moderately long. Femur II with two false sutures; III with none and IV with one.

Genotype.— *Liopagus simplex*, sp. nov.

Related to Prionostemma Pocock in the presence of false sutures only on second and fourth femora. From that genus it is most easily distinguished in having on femur II only two sutures or joints instead of the three uniformly present in Prionostemma.

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[1] λεῖος, smooth, πάγος, a peak.

LIOPAGUS SIMPLEX, sp. nov.

Plate **5**, fig. 4–8.

Body above brownish grey, darker caudad; similar below with a darker brown or dusky stripe across each abdominal segment. Femora toward distal end each with a conspicuous deep black annulus. Legs brown; patellae and the distal ends of tibiae darker.

Body nearly parallel sided from level a little back of eye-tubercle to one a little caudad of ends of coxae IV, then abruptly narrowing to caudal end and semicircularly rounded in front. Obscurely granular in a line across border of segments.

Eye-tubercle as wide as high. Viewed from behind appearing conspicuously constricted at base, the front face subvertical, not so convex as the caudal. Tubercle wholly smooth; slightly depressed longitudinally along middle line, (Plate **5**, fig. 4, 5).

All joints of legs free from tubercles but with scattered very fine teeth on femora and a large one at distal end above on femora and patellae. Coxae with a single slender process from distal end above.

First joint of mandible smooth, with the process below as usual; a few short hairs above and a series of them along a mesoventral line. Second joint small; with a few short hairs above, glabrous beneath, (Plate **5**, fig. 6).

Femur of pedipalp between two and three times as long as the patella without its apophysis; with a series of short stout hairs beneath and smaller, less erect ones on dorsal surface but with no teeth. Patella with apophysis moderately slender, cylindric, more densely clothed with hair. Tibia also with more numerous short stiff hairs; a slight rounded process at distomesal corner, this clothed with hairs as elsewhere on joint. Tarsus with numerous fine short appressed hairs and fewer shorter, stiff erect hairs. Claw pectinate, (Plate **5**, fig. 7, 8).

Length *cir.* 3.5 mm. Leg I missing. Length of leg II *cir.* 42 mm.; of leg III, 21.5 mm.; leg IV broken off at tip.

Locality.— Huadquina, 5,000 feet, July 30. (Type, M. C. Z. 138).

ARANEIDA.

AVICULARIIDAE.

Hemirrhagus peruvianus, sp. nov.

Plate **6**, fig. 4–10; Plate **7**, fig. 1–2.

Integument of carapace, chelicerae, femora of legs and palpi, sternum and labium dark chocolate-brown, the other parts of legs and palpi lighter brown, in part of dilute reddish tinge; sternum and femora of legs beneath sometimes lighter than above. Integument of abdomen brown, paler beneath than above; above with a small light area toward anterior end. Carapace covered with a woolly coat of russet-brown hair of a more or less coppery lustre, and some longer grey ones at caudal edge especially. The legs are thickly clothed with short brownish hairs with deep black ones more sparsely intermixed; the numerous longer bristles are dark proximally, becoming grey, grey or white distad, these forming rather indistinct longitudinal streaks on the femora and patellae. Abdomen densely clothed with brown hair of a distinctly coppery lustre, that of anterior surface black and forming a distinct black area; longer bristles of dorsal surface grey distally; sometimes dark hairs form a larger element on the ventral surface and this surface then appears dark grey or blackish instead of copper-brown as more usual. Fringes of endites and chelicerae orange proximally, lighter distad.

Eye-tubercle sharply limited; of moderate height. Eye-area less than twice as wide as long in both male and female (67:37); rows subequal or the posterior one slightly longer than the anterior (up to ratio 67:65). Anterior row of eyes in dorsal view a little procurved; in anterior view rather strongly procurved. Anterior median eyes with diameter not much more than half that of the laterals (*cir.* 6:11), a little more than their radius apart, but decidedly less than their radius from the laterals. Posterior row of eyes conspicuously recurved. Posterior laterals smaller than the anterior laterals from which separated by less than their radius. Posterior medians three fourths the diameter of the laterals; mesal side more curved than the ectal, more or less angulate anteroectally, (Plate **6**, fig. 4).

Head low, only slightly rising in front of the thoracic groove;

highest some distance caudad of eyes. Thoracic fovea some distance back of middle of carapace; straight, transverse.

Sternum subequal in length and breadth, being sometimes slightly longer than wide (male) and sometimes slightly wider than long (female). Moderately convex. Sigillae submarginal.

Labium a little wider than long. Spinules in a transverse band of about four rows, irregularly and closely arranged.

All tarsi densely scopulate; the scopulae of the anterior tarsi divided by a narrow setose line, those of the posterior tarsi by a broad setose band which, however, is narrower than the joint. Anterior metatarsi scopulate mostly more than half way to base, the posterior metatarsi scopulate at distal ends only. Hair on anterior surface of coxa I both above and below suture moderately long, in part prone, with in addition a number of finer and shorter straight hairs which tend to be somewhat clubbed at tip; no spinescent bristles. Paired claws bearing from three to four moderate teeth, commonly three or two being fully developed with one or two appearing as mere points, (Plate 7, fig. 1, 2). In addition to the scales of the ordinary type occurring on dorsal surface of tarsi, (Plate 6, fig. 5) occasionally one of the second type, (Plate 6, fig. 6), is to be seen.

Metatarsus I ventrally with an apical and a subbasal spine, a long one also on anterior surface. Tibia of male with three spines along ventrocaudal line and a fourth a little more dorsad; or with spines as many as seven to none, there being on caudoventral surface three basal, two submedian and one apical, and on anteroventral a pair toward apex and one lateral surface (male from Huadquina); the number may differ on the right and left legs of same specimen. Patella armed with a spine on caudal surface (male). Metatarsus IV with three pairs of ventral spines and two on anterior and also on posterior surface (female) or with five or six on each lateral surface (male).

Inferior spur of tibia I of male longer than the superior, moderately curved and bearing a large stout black spine inserted on its dorsocaudal surface. The superior spur bearing a similar stout spine on mesal surface, (Plate 6, fig. 7).

Tibia of male palpus thicker proximally than patella or femur, narrowing distad; a narrow ridge on mesal side from middle distad, elevated at distal end into a low tubercle. Tarsus short, bilobate as usual. Palpal organ with spine in lateral view appearing at right angles to the main axis of bulb, narrowing distad, with apex slender and acute, below tip with a short, stout, subtriangular spur. In anterior view the tip of process is seen to curve rather abruptly ectad, the spine occurring at the bend on the convex side, (Plate **6**, fig. 10).

Male (*Tincochaca*). Length, 15 mm. Length of cephalothorax, 7.3 mm.; width, 6.0 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	6.2 mm.	9.0 mm.	4.0 mm.	3.5 mm.	24.7 mm.
Leg II	6.0	7.0	3.6	3.0	19.6
Leg III	5.1	6.2	4.6	3.0	18.9
Leg IV	7.2	8.5	7.0	4.0	26.7

Female (*Tincochaca*). Length, 17 mm. Length of cephalothorax, 8.5 mm.; width, 7.0 mm.

	fem	tib.+pat.	met.	tar.	total
Leg I	5.8 mm.	7.8 mm.	3.3 mm.	3.2 mm.	20.1 mm.
Leg II	5.1	6.2	2.7	2.6	16.6
Leg III	4.6	5.7	3.3	3.2	16.8
Leg IV	6.0	8.0	5.4	3.2	24.6

Localities.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 139, male; paratype, immature female 324). Tincochaca, 7,000 feet, August. (M. C. Z. 140, male and female). Santa Ana, 3,000 feet, August. (M. C. Z. 141, one female). Urubamba, 9,500 feet, July 18. (M. C. Z. 325).

HEMIRRHAGUS MAJOR, sp. nov.

Plate **7**, fig. 3–8.

Integument of carapace, sternum, legs, and palpi dark brown or chocolate to chestnut; that of labium and endites reddish brown or chestnut. Hairs of carapace somewhat wavy, moderately thick, light brown of more or less dark golden or bronze lustre. Hair of chelicerae dense, light brown or bronze lustre. Sternum clothed with a dense coat of short brown hair with black ones sparsely intermixed; bristles dark proximally, rufous distally, mostly of moderate length. Legs clothed with a coat of short brown hair with darker dusky or blackish hairs intermixed and especially abundant on dorsal surface of femora, the brown hair in part of shining brown lustre; a narrow stripe of grey or white hairs across ends of joints above; two longitudinal stripes on patellae above formed by hair free and bristle free areas over which the lighter hairs unmixed with dark extends from each side. Bristles of legs shorter proximad, becoming longer and more numerous especially on tibiae ventrally and on metatarsus above as well as laterally and ventrally; bristles dark proximally, becoming light rufous distally, rather coarse. Integument of abdomen above dark, somewhat dusky brown, ventrally lighter brown, with several small obscure white spots on each side; bristles of dorsum subdense, forming a light brick-red area.

Eye-tubercle black, well defined, moderate in height, highest between posterior median eyes, more strongly convex anteriorly than posteriorly. Eye-area trapeziform, the posterior row being distinctly longer than the anterior, the difference typically distinctly more marked than in *peruvianus* (up to 85:78); area from a little less than half as long as greatest width to a little more thus also differing from *peruvianus*. Anterior row of eyes from moderately procurved to nearly straight, much more procurved in anterior view than in dorsal. Anterior median eyes with diameter two thirds that of laterals; about two thirds their diameter apart, less than their radius from the laterals. Posterior lateral eyes about three fourths the diameter of the anterior laterals, less than their radius from the latter. Posterior medians pyriform in outline, being narrowed to a point caudad and widely rounded cephalad, (Plate **7**, fig. 3).

Head moderately elevated, in outline slightly convex, highest a little caudad of eye-tubercle. Fovea straight or vaguely procurved, short and deep.

Sternum longer than wide. Posterior sigillae about their length from margins. Median ones submarginal; anterior marginal.

Mesal margin of furrow or chelicera bearing a row of fourteen teeth.

Labium wider than long, truncate distad. Spinules in a narrow band (about four rows deep) across distal end, the spinules not dense.

Spinules on proximal end of endite rather numerous.

Anterior surface of coxa I with longer in part semiprone hairs and some of the short, slender, distally obtuse or clubbed hairs such as are present in *peruvianus* but in addition below the suture with numerous dark, strongly chitinized spiniform bristles, these more numerous distally, some rather more slender ones also occurring above suture.

Tarsal claws four or five (anterior and posterior of leg I respectively), proportionately shorter, more slender and more uniform than in *peruvianus*. On the posterior claws, which are longer and proportionately more slender, one or two extra points may occur in addition to the five ordinary teeth, (Plate **7**, fig. 5–7).

Scopulae of anterior tarsi divided by a narrow setose line, the posterior ones by a broader one, but this much narrower than the joint. Anterior metatarsi scopulate well toward base; posterior with scopular hairs only distally and there sparse or absent. Metatarsus I (female) ventrally with a pair of small apical spines and a single one proximad of middle. Tibia I (female) also ventrally with a pair of spines at distal end and a single submedian one; in the male with seven spines on ventral and ventrocaudal surface and two on anterior surface. Metatarsus IV with fifteen to eighteen spines irregularly arranged; tibia IV with eight to ten.

In the male the metatarsus of leg I is abruptly much more slender than the tibia and is strongly bowed dorsad. The spurs of the tibia are elevated on a conspicuous common basal process standing at right angles to the article; the inferior process is not much longer than the superior but it is proximally stouter being narrowed distad, moderately curved toward end, bearing on dorsal surface a dark, stout, acute process attached near apex and corresponding to the larger one of *peruvianus;* superior process directed more cephalad, more uniform in diameter, curved a little mesad toward tip, the spine rather slender, closely applied to surface excepting at tip which is divergent, (Plate **7**, fig. 4).

In the male palpus the tibia is thicker than the patella or femur, narrowing distad, a narrow ridge-like thickening mesoventral edge from middle distad and elevated at distal end into a low tubercle, ventrally with a dense growth of long bristles. Tarsus short, bilobate as usual, the mesal lobe at distomesal corner adjacent to bulb extended into a blackish, densely chitinized tubercle. Spine of bulb proportionately much longer than in *peruvianus*, basal part with axis corresponding with long axis of bulb, curving semicircularly first ventrad and then forwards as shown in the figure, a slight tooth a little distad of middle, in anterior view the process bends first somewhat ectad.

Male (Type, *Cuzco Valley*). Length, 29 mm. Length of cephalothorax, 14 mm.; width, 12.3 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	10.8 mm.	14 mm.	8.1 mm.	5.4 mm.	38.3 mm.
Leg II	10	12.2	7.8	5	35.0
Leg III	9	11.2	8.3	4.5	33.0
Leg IV	11.2	14.2	11.2	5.8	42.4

Tibia I, 7.1 mm. Tibia IV, 8.9 mm.

Female (*Urubamba*). Length, 37 mm. Length of cephalothorax, 15.8 mm.; width, 13.1 mm. (In a female from Cuzco Valley the cephalothorax is proportionately broader, the ratio of length and breadth being 16:14.3).

	fem.	tib.+pat.	met.	tar.	total
Leg I	11.8 mm.	15.3 mm.	7.5 mm.	5.6 mm.	40.2 mm.
Leg II	11.0	13.0	7.1	5.3	36.4
Leg III	10.0	11.8	8.8	5.5	36.1
Leg IV	12.5	15.5	13.0	6.4	47.4

Localities.— Cuzco Valley. (Type, M. C. Z. 142, one male; paratype, M. C. Z. 143, one female) E. D. Flint coll. Urubamba, 9,500 feet, July. (M. C. Z. 144, one female).

HEMIRRHAGUS sp.

Locality.— Urubamba, 9,500 feet, July. (M. C. Z. 326, several immature females).

EURYPELMA AYMARA,[1] sp. nov.

Integument of carapace when dry black or nearly so, when wet appearing of slight chestnut tinge. Sternum chestnut, darker cephalad. Labium nearly black. Endites chestnut. Legs proximally blackish like the carapace, becoming slightly more chestnut distad. Carapace clothed with a coat of sandy grey and light brown hair of a golden lustre. Hair of femora dusky brown of rufous tinge, that of more distal joints with a larger proportion of grey intermixed; bristles numerous and long, of rufous or rust color proximally, paler, greyish yellow distad. Hair of venter of abdomen brown and black intermixed, chiefly the latter. Dorsum with a thick coat of long rufous bristles.

Pars cephalica moderately high, highest a little caudad of eye-tubercle.

Eye-tubercle rather high, sharply limited; highest along the median longitudinal line which descends a little from between the posterior median eyes cephalad. Eye-area considerably less than twice as wide as long (25:16). Anterior row of eyes slightly shorter than the second (25:24); in dorsal view considerably procurved, a line tangent to the anterior edges passing through the anterior third of the lateral eyes. Anterior median eyes much smaller than the laterals, their diameters being about as 2 to 3; medians three fourths their diameter apart and near the same distance from the laterals. Posterior lateral eyes of nearly same size as the anterior laterals from which they are separated by less than their radius. Posterior median eyes much smaller than the laterals; oblong, with sides straight and ends more rounded. A line tangent to caudal edges of the two posterior eyes of each side intersects the anterior median eye of opposite side.

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[1] Aymara, a tribe of the indigenes of Peru.

Metatarsus I and II scopulate very nearly to base; metatarsus III scopulate over distal third; metatarsus IV scopulate only at distal end.

Female. Length 38 mm. Length of cephalothorax, 21.2 mm.; width, 18.1 mm. Length of pars cephalica, 13.8 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	15 mm.	20.9 mm.	10 mm.	6.5 mm.	52.4 mm.
Leg II	13.8	18.1	9.9	6.1	47.9
Leg III	12.3	16	11	6.1	45.4
Leg IV	15.7	20	15.6	6.8	58.1

Locality.— Peru: Aymas, Dr. W. H. Jones. (Type, M. C. Z. 145, one female).

This seems to be the only true Eurypelma thus far recorded from Peru.

DIPLURA MONTICOLENS,[1] sp. nov.

Plate 7, fig. 9–10.

Cephalothorax dusky brown, the margins of carapace and the eye-area darkest. Edges of sternum darker than median portion. Chelicera palpi and legs testaceous. Integument of abdomen dark above, light beneath; a series of three pairs of obscure light stripes extending from near dorsal median line obliquely ventrocaudad across sides. Spinnerets testaceous, in part dusky, especially at ends. Hair of carapace light brown, those of sternum sparse, darker. Bristles of abdomen dark rufous brown, the shorter hairs mostly lighter.

Eye-area twice as wide as long or very nearly so (67:34). Eye-tubercle highest beneath anterior median eyes, behind which it descends almost immediately and also slopes laterally from this point, the eyes being set obliquely to the horizontal plane. Anterior row of eyes in dorsal view a little procurved, in anterior view strongly recurved. Anterior median eyes inclusive of rim with diameter more than three fourths as great as that of the anterior laterals, less than their radius from each other and closer to the laterals; exclusive of rim the median eyes are less than their diameter apart and are near their radius from laterals. Anterior laterals very oblique, the anterior, narrow end lying in front of the ectal edge of the median eye. Posterior lateral eyes clearly smaller than the anterior laterals (diameters nearly as 3:4). Posterior median eyes smaller than laterals, closer to them than to the anterior medians. A line tangent to the caudal edges of posterior eyes on each side is tangent to or passes near caudal edge of anterior median eye of opposite side, (Plate **7**, fig. 9, 10).

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[1] *Mons*, mountain, *incolens*, inhabiting.

Cephalothorax broad and low anteriorly (the width across eye area to greatest width about as 47:76). Thoracic fovea small, oval, transverse, situated considerably behind middle of length of carapace.

Labium much wider than long, with anterior margin mesally incurved. On anterior edge with two spinules present, a scar in type seeming to indicate the normal presence of a third one.

Endites at proximal corner with a small group of few (8–10) spinules.

Sternum as wide as long. The sigillae marginal.

Tarsi of legs slender, all conspicuously curved, those of the anterior pairs most strongly so. Paired claws each with a double row of mostly eight teeth. Inferior claw smooth, slender. Metatarsus I with three pairs of ventral spines; femur I with a spine at distal end on anterior side and above and another smaller one on the posterior side; other femora with corresponding spines, the posterior one increasing in size in going caudad. Posterior metatarsi much more strongly spined. None of the tarsi spined.

Posterior spinnerets as long as abdomen; slender; articles subequal, the first thickest, the distal one most slender, narrowing distad. Anterior spinnerets short, distally acuminate.

Female. Length 8.4 mm. Length of cephalothorax 3.4 mm.; width, 2.8 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	3.4 mm.	4.5 mm.	2.9 mm.	2.2 mm.	13.0 mm.
Leg II	3.1	4.1	2.8	2.2	12.2
Leg III	2.9	3.8	2.8	2.0	11.5
Leg IV	4.0	5.0	4.0	2.5	15.2

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 146, female).

Brachythele keithi, sp. nov.

Plate **7**, fig. 11.

Integument of cephalothorax and legs light chestnut-brown; that of the chelicerae dark chestnut; integument of abdomen and spinnerets clear brown. Pubescence of carapace brown of golden lustre; that of abdomen dense, of similar golden brown color or of more coppery lustre.

Eye-tubercle strongly convexly elevated between the posterior median eyes. Eye-area twice as wide as long (45:22); anterior row a little shorter than the posterior (45:42). Anterior row a little procurved. Anterior median eyes a little more than their radius apart, closer to the lateral eyes; diameter but little more than two thirds the longer diameter of the lateral eyes (ratio near 23:31). Posterior lateral eyes slightly longer than the anterior (33:31). Posterior median eyes elongate, narrowed caudad, length to width about as 3:5 — smaller than lateral eyes (lengths as 25:33), nearer to these than to anterior medians. A line tangent to caudal edges of posterior eyes on each side in type passing through anterior third of opposite anterior median eye, (Plate **7**, fig. 11).

Labium clearly wider than long; distal margin mesally incurved. Spinules none.

Spinules on proximal corner of endites short and stout, constricted near or a little above base, distally expanded and rounded.

Thoracic fovea recurved.

Sternum longer than wide; gently convex. The sigillae at level between second and third legs most distinct, marginal. Sternum with numerous fine tubercles from each of which arises a hair.

Paired claws with teeth in two rows; teeth of each row mostly seven or eight in number. Unpaired claw smooth. Tarsal scopulae dense, extending to base; none divided by a setose line or band. Spines long and moderately stout, black.

Posterior spinnerets more than two thirds as long as the abdomen ventrally; the three joints subequal in length, decreasing in diameter distad, the second being more slender than the first and the third than the second. Anterior spinnerets twice or more their diameter apart at base.

Female. Length, 30 mm. Length of cephalothorax, 14 mm.; width, 12 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	12 mm.	15 mm.	9.5 mm.	8 mm.	44.5 mm.
Leg II		missing			
Leg III	10	12.5	10	7.5	40.0
Leg IV		missing			

Length of spinnerets 12.2 mm.

Locality.— Huadquina, 5,000 feet, wet season. (Type M. C. Z. 147, one female).

Named for Minor C. Keith of New York.

BRACHYTHELE INCURSUS, sp. nov.

Plate **7**, fig. 12.

Integument of cephalothorax and legs brown, that of carapace and femora of legs above deeper in color; chelicerae above blackish brown. Integument of abdomen above dusky brown; below light brown. Spinnerets blackish. Hair of carapace and abdomen golden brown. Hair of sternum blackish. Fringe of chelicerae rufous.

Eye-area less than twice as wide as long (57:30). Anterior row of eyes of same length as posterior. Anterior row straight. Anterior median eyes slightly more than their radius apart (6:5.5), nearer to the laterals; diameter but little more than half that of lateral eye (11:20). Posterior lateral eyes clearly smaller than the anterior laterals (ratio of diameters 3:4), lateral eyes nearly contiguous as usual. Posterior median eyes elliptic, about three fourths as wide as long, four fifths as long as the laterals. A line tangent to caudal edges of two posterior eyes of each side passes clearly caudad of anterior median eye of opposite side, (Plate **7**, fig. 12).

Labium wider than long in the ratio 9.5:6.8; distal margin a little incurved. A row of low stout, rounded spinules across apical portion.

Endites at proximal corner with the patch of spinules as usual.

Thoracic fovea a little recurved.

Sternum longer than wide. Hairs not dense, black, longer about margins.

Paired claws of legs each with two rows of from six to eight teeth. Single claw smooth. In the stage of growth represented by the type the anterior tarsi are not densely scopulate and the metatarsi are scopulate only distally; the posterior tarsi are scopulate only distally, ordinary bristles covering the proximal portion while the metatarsi are not at all scopulate. The tarsi are not armed. Patellae, tibiae, and metatarsi armed with stout black spines as usual.

Spinnerets short, about one half the length of the abdomen on ventral side, much less slender relatively than in *keithi:* each joint attenuated distad. Black in color.

Female (*not fully mature*). Length, 13 mm. Length of cephalothorax, 6.2, mm.; width, 5 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	4.3 mm.	5.6 mm.	2.8 mm.	2.0 mm.	14.7 mm.
Leg II	4.0	4.7	2.3	1.8	12.8
Leg III	3.2	4.1	2.2	1.8	11.3
Leg IV	4.3	5.5	3.2	2.0	15.0

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 148, one young female).

The female described above is apparently not fully grown; but the differences it presents especially in eye sizes and relations added to the differences in proportions of joints of legs, the presence of spinules on the labium and especially the pronounced differences in form and relative length of spinnerets render it impossible to regard it as identical with the preceding species which comes from the same locality.

ULOBORIDAE.

ORINOMUS,[1] gen. nov.

Posterior eyes small, subequal, the series strongly recurved, narrower than the cephalothorax, the medians farther apart than from the laterals. Anterior eyes in a procurved series; medians farther from laterals than from each other. Area of median eyes much wider than long and much narrower in front than behind.

First leg much the longest, the others in order IV, II, III. Metatarsus I clearly shorter than tibia + patella I. Calamistrum not reaching distal end of metatarsus IV.

Cribellum narrow; entire.

Abdomen subglobose; bigibous above, not produced or acuminate behind; spinnerets not quite terminal.

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[1] ’ορεινόμος, mountain ranging.

Genotype.—*Orinomus lamprus*, sp. nov.

Apparently closest to Uloborus, a genus occurring widely in this and adjoining regions as well as elsewhere.

ORINOMUS LAMPRUS,[1] sp. nov.

Plate **8**, fig. 1–4.

Carapace nearly black, a narrow median longitudinal line yellowish, the clypeus also paler. Carapace clothed with grey hair. Sternum black; a pale median mark. Coxae dusky beneath. First legs with femora, patellae, and tibiae black, with a few small light spots; metatarsi and tarsi yellow. Other legs yellow, with dusky annuli. Abdomen somewhat yellowish white, finely spotted with black, a dark median longitudinal line over entire length and a deeper, more distinct one on each side from the hump caudad; venter with a geminate black stripe along the middle.

Posterior row of eyes conspicuously recurved, a line tangent to caudal edges of median eyes passing through the anterior third of laterals; median eyes three times their diameter apart, half as far from the laterals which are nearly of same size. Posterior lateral eyes as far from the anterior laterals as from the posterior medians (once and a half their diameter), the anterior laterals with diameter two thirds as large. Anterior median eyes only a little more than their diameter apart but more than once and a half their diameter from the laterals; row conspicuously procurved. Area of median eyes wider than long nearly in ratio 5:3; twice as wide behind as in front. Clypeus slanting ventrocephalad; about equal in width to diameter of median eye.

Labium wider than long; subtriangular, the sides being straight and meeting at an angle, (Plate **8**, fig. 4).

Sternum caudally produced as a short tongue between the separated posterior coxae, the tongue rounded at end. More than twice as wide as long (20:9), (Plate **8**, fig. 2).

Female. Length 3 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	1.6 mm.	1.6 mm.	1.2 mm.	.6 mm.	5.0 mm.
Leg II	1.0	1.1	1	.3	3.4

Locality.— Urubamba, 9,500 feet, July. (Type, M. C. Z. 149, one female).

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[1] λαμπρός, distinct.

DICTYNIDAE.

Amaurobius, sp. a.

An immature male and female from Ollantaytambo (9,000 feet, July. M. C. Z. 150). The abdomen is marked with a distinct median longitudinal black stripe of narrowly hastate form and with indented edges and with a bright white spot each side of middle of its length. Carapace with head dark brown, elsewhere dusky. Sternum dark, dusky brown.

Two immature males apparently of same species from Urubamba (9,500 feet, July. M. C. Z. 151). They are darker throughout, the sternum being nearly black and the abdomen so dark that the dorsal median black line is almost obliterated; but the two white spots are conspicuous.

Amaurobius sp. b.

One immature female with lateral eyes nearer together than usual in the genus. Carapace yellow with each eye enclosed in black. Sternum light brown, a little dusky. Legs yellow, tibiae very obscurely ringed. Abdomen grey of olive cast; above conspicuously marked with a series of dark chevron lines from middle caudad, all of which are broken at middle.

Locality.— Urubamba, 9,500 feet, July. (M. C. Z. 152).

Amaurobius platei Cambridge.

Journ. Linn. soc. London, 1898, **27**, p. 18, pl. 2, f. 3.

One specimen probably this species was secured at Ollantaytambo, 9,000 feet in July. (M. C. Z. 166).

Aymarella,[1] gen. nov.

Pars cephalica relatively broad, convex, and high.

Anterior row of eyes substraight or slightly procurved, the medians much smaller than the laterals, farther from the laterals than from each other. Posterior row of eyes recurved; subequal, the medians farther from the laterals than from each other. Area of median eyes distinctly narrower in front than behind. Lateral eyes close together, not more than their radius apart.

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[1] Diminutive of Aymara.

Clypeus narrower than the anterior lateral eyes.

Chelicera with lower margin short, but little oblique, armed with two (or three) small teeth; upper margin with three teeth of which the median one is largest.

Labium longer than wide, narrowed distad, obtuse.

Length of legs in order I–IV, II, III. Robust. Moderately spined. Metatarsi much longer than the tarsi.

Cribellum bipartite. Calamistrum uniseriate.

Genotype.—*Aymarella munda,* sp. nov.

This genus would seem to be closely related to Calleva, a genus based by Simon upon an Argentine species; but it differs clearly in having the lateral eyes much closer together, in having the legs spined, and in having the metatarsi much longer than the tarsi. Callevopsis, a Chilean genus, differs, *e. g.*, in having the eyes of the anterior row equidistant and the lower margin of the chelicera armed with four teeth.

AYMARELLA MUNDA,[1] sp. nov.

Plate 9, fig. 1–5.

Carapace brown to fuscorufous with darker lines radiating from thoracic furrow. Sternum fuscous to nearly black; clothed with numerous black hairs. Legs testaceous, typically of rufous tinge distad on anterior pairs; femora darker, dusky to nearly black.

Palpi fuscous. Chelicerae nearly black. Labium and endites very dark, pale across tips. Abdomen olive-grey; without distinct markings but in some with a median hastate mark very vaguely outlined in dark and followed behind by several faint light colored chevron lines, the lines very thin, and also a small light dot each side of middle median mark.

Posterior row of eyes decidedly longer than the anterior (3.4:2.9), a little recurved; median eyes smaller than laterals (7:9), 1.7 their diameter apart, a third farther from the laterals. Anterior row of eyes viewed from above with line of apices a little recurved; viewed from in front the line of centres is a little procurved; median eyes with diameter about three fifths that of the laterals; laterals on well-marked tubercles. Area of median eyes narrower in front than behind in ratio 10:13. Lateral eyes usually their radius apart, the distance being somewhat variable.

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[1] *mundus*, fine, neat.

Pars cephalica large, conspicuously elevated, highest immediately behind eye-area, smooth and shining, (Plate **9**, fig. 1).

Sternum longer than wide in about ratio 5:4. Caudal process short, narrow, (Plate **9**, fig. 2).

Labium grooved across base as usual; narrowed conspicuously from above groove distad; distally obtuse, (Plate **9**, fig. 3).

Tarsus of palpus armed with a claw and a number of spines; other joints unarmed.

Femur I armed with a single spine on anterior surface toward distal end; other femora unarmed. Patellae unarmed. Tibia III armed on anterior surface in subapical position with one spine; other tibiae unarmed. Metatarsi I and II armed ventrally with three pairs of spines; IV also with spines which are not distinctly arranged in pairs but are more distributed along surface of joint.

Superior margin of furrow of chelicera armed with three teeth of which the median is largest; lower margin nearly transverse and with two rather small teeth.

Abdomen broadly subelliptic in outline.

Cribellum bipartite, (Plate **9**, fig. 5).

Female (*San Miguel*). Length 8 mm. Length of cephalothorax 3.2 mm.; width, 2.2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.5 mm.	3 mm.	2 mm.	1.2 mm.	8.7 mm.
Leg II	2.25	2.7	1.9	1	7.85
Leg III	2.1	2.2	1.5	1	6.8
Leg IV	2.5	3.1	2	1.1	8.7

Localities.— San Miguel, 6,000 feet, July. (Type, M. C. Z. 153 female; paratypes, M. C. Z. 154, females). Torontoy, 8,000 feet, July. (M. C. Z. 155, several females). Lucma, 7,000 feet, August (M. C. Z. 156). Urubamba, 9,500 feet, July. (M. C. Z. 157, one female). Huadquina, 5,000 feet, July. (M. C. Z. 158, one female). Ollantaytambo, 9,000 feet, July. (M. C. Z. 159, one female).

AUXIMUS sp.

A single immature male of a species of this genus was secured at Lucma in August. (M. C. Z. 160).

AUXIMUS PRODUCTUS, sp. nov.

Plate 8, fig. 5–7.

Carapace dusky brown or fuscous. Caelicerae similarly dusky over a more reddish or chestnut background. Legs testaceous; the tibiae, tarsi, and metatarsi of legs I and II dusky, almost black or tibia with an apical and a broader subbasal dark annulus indistinctly set off; tibiae of legs III and IV with apical and subbasal dusky annulus distinct and metatarsus of these legs with an apical and a broader, less distinctly limited subbasal dark band. Patellae dusky. Femora without rings or distinct marks, usually dusky beneath proximally. Tibia and tarsus of palpus dusky or almost black like the distal articles of anterior legs. Sternum dusky brown. Labium and endites darker than sternum, pale across tips. Abdomen above with background of greyish yellow of slight olivaceous tinge; at base above with a black median sagittate stripe the acute apex of which is at middle; this mark is followed caudad by a series of four, successively smaller and smaller chevron-shaped black lines the angle of the first of which is at the point of the sagittate mark; chevron marks with ends on each side united by a longitudinal black line. Dorsum elsewhere with small black, in part angular, dots, these more numerous on the sides where they are confluent with enclosed areas dusky and entire surface thus appearing blackish. A broad median band along venter immaculate greyish yellow of slight olivaceous cast like background of dorsum.

Posterior row of eyes considerably procurved, a line through middles of median eyes being nearly tangent to caudal edges of laterals; median eyes clearly less than twice their diameter apart (11:7) and nearly the same distance from the laterals; smaller than the laterals (7:9). Anterior row of eyes with line of apices as seen from above very slightly procurved; viewed from in front the row is nearly straight, the centres of the laterals being slightly lower; median eyes with diameter half as great as that of laterals, four fifths their diameter apart, nearly same distance or slightly farther from laterals. Anterior laterals equal to posterior laterals from which they are separated by a distance not more than equalling half the radius.

Labium about two thirds as broad at base as long; narrowed distad; apically truncate.

Sternum longer than wide, the length inclusive of caudal process being to width as 9:6.5 and the length only to level of anterior proximal corner of coxa IV being as 7:6.5.

Abdomen in outline broadly subovate.

Lower margin of furrow of chelicera with six teeth of which the two farthest from claw are much smaller and the first is smaller than the succeeding three.

All femora dorsally with a submedian spine and at distal end with one toward anterior side and there may be a smaller one in corresponding position on posterior side. Tibia I with a submedian pair of spines on ventral side and a single one on anterior side between middle and proximal end. Tibia II with a single submedian ventral spine; and tibiae III and IV unarmed. Metatarsus I with three pairs of ventral spines.

Femur of palpus with a spine in submedian position above; tibia with three long, almost bristle-like, spines, two toward mesal side above and one ectal in position; tarsus with numerous spines, the proximal ones long and slender, the distal ones shorter and stouter.

Female. Length, 7.5 mm. Length of cephalothorax, 3 mm.; width, 2.5 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.4 mm.	3.25 mm.	2.1 mm.	1.1 mm.	8.85 mm.
Leg II	2.2	2.9	2	1.1	8.2
Leg III	2.2	2.2	1.6	1	7.0
Leg IV	2.4	2.9	2	1.25	8.55

Locality.— Tincochaca, 7,000 feet, August. (Type, M. C. Z. 161, one female).

While a number of species of Auximus have been described from Ecuador, only one was previously known from Peru, *A. funestus* (Keys.), a species differing rather widely from the present one in having its posterior row of eyes straight, in the sparser spining of legs, in the different form of epigynum as well as in color.

DICTYNA HESPERIA,[1] sp. nov.

Plate 8, fig. 8.

Thoracic part of carapace fuscous, yellow along edges; head testaceous. Legs and palpi yellow, the tarsi in part dusky. Sternum yellow, faintly dusky. Labium dusky yellow. Abdomen opaque yellowish white, venter covered with a broad, more or less dusky band, a more blackish area about the spinnerets; above there is a median dorsal accent shaped black stripe with point cephalad and base at middle; enclosing dorsal area is a dark band of elliptical form with a cross connection toward caudal end, also united with anterior band along middle line, and a network of finer dark lines connecting with the median dark mark elsewhere within the ellipse.

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[1] ἑσπέριος, western.

Posterior row of eyes a little recurved; a little longer than the anterior row; median eyes farther from each other than from the laterals; laterals equal to the medians. Anterior row of eyes in dorsal view recurved in such degree that a line tangent to anterior edges of laterals passes through the posterior fourth of medians; in anterior view the row is straight; median eyes but little smaller than the laterals, near their diameter apart and three fourths as far from the laterals. Area of median eyes somewhat trapeziform, the width anteriorly being less than that posteriorly in about ratio 5:6. Anterior lateral eyes their diameter from lower edge of clypeus.

Epigynum with openings widely separated, protected by laminae, (Plate **8**, fig. 8).

Sternum much longer than wide (18:13).

Cribellum undivided as in most species.

Female. Length 3.25 mm. Length of cephalothorax 1.1 mm.; width .86 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	1.38 mm.	1.3 mm.	.9 mm.	.6 mm.	4.18 mm.
Leg II	1.3	1.12	.74	.48	3.64
Leg III	1.2	1	.7	.44	3.34
Leg IV	1.38	1.3	.86	.5	4.04

Locality.— San Miguel 6,000 feet, July. (Type, M. C. Z. 162, one female).

Four species, all based similarly upon females, have been previously described from Peru. The present species is most readily separated from these and other South American species through the different form of the epigynum, the eye relations, and the coloration.

SCYTOTIDAE.

Loxosceles rufescens (Dufour).

Scytodes rufescens Dufour, Ann. gén. sci. phys., 1820, **4**, p. 203, pl. 77, f. 5.

Numerous specimens of both sexes were taken at Huadquina in July and August, 5,000 feet. (M. C. Z. 163, 164). This species is widespread in both hemispheres.

THOMISOIDES Nicolet.

Nicolet, Gay hist. Chile. zool., 1847?, pl. 1 Arachn., 1849, **3**, p. 352.

As Plate I of Nicolet's work on spiders in Gay's Histoire de Chile was issued and in Walckenaer's hands before the publication of volume four of the Histoire naturelle des Insectes Apteres, the species illustrated on that plate and named at the bottom must be dated at the latest from 1847 rather than from 1849 when the text was published, since the issuance of figures of this kind with accompanying names constitutes publication. Thomisoides is used in the legend of the plate in combination with specific names and must accordingly be regarded as having been established at the same time. Walckenaer's genus Sicarius, like his species *thomisoides*, was based upon the published plate of Nicolet's work, and I can see, therefore, no other way than to drop both Sicarius and *thomisoides* as clear synonyms.

THOMISOIDES TERROSUS Nicolet.

Plate **9**, fig. 6–10; Plate **10**, fig. 1–3.

Thomisoides terrosus Nicolet, Arachn. pl. 1, fig. 9, Gay's Hist. Chile, 1847?, Gay's Hist. Chile, 1849, **3**, p. 352, Arachn., pl. 1, fig. 9.
Sicarius terrosus Simon, Hist. nat. Araign., 1893, **1**, p. 271.

In alcohol the cephalothorax is reddish brown, the abdomen grey-brown, and the legs and sternum brown of lighter shade than carapace.

Cephalothorax wider than long; width across head decidedly less than half the greatest width; low; shorter than tibia I but longer than tibia IV. The margins and the anterior surface of the head bearing numerous short, stout, spiniform bristles which are distally blunt and toothed like those of the legs.

Sternum almost circular, equal in length and breadth (3.15 mm.) or very slightly wider than long; depressed behind at middle in front of caudal margin and giving the appearance of being deeply emarginate though the caudal edge at middle is really convexly rounded; with two or three rows of stiff bristles along the edge and smaller bristles arranged on radii with their free ends towards centre of sternum; between the bristles short fine hair.

Labium gradually narrowing from base distad; tip obtusely rounded; about two thirds as wide at middle as long, length in measured specimen 1.6 mm., (Plate **9**, fig. 8).

Endites very long, arched and meeting in front of labium in usual way. Endites and labium covered with stiff short hairs like those of sternum.

Claw of chelicera small; apparently less strongly curved than usual in the family; chitinous appendage rather large, overlapping apical portion of claw, (Plate **9**, fig. 7, 9) covered with stiff bristles.

Clypeus very wide, the distance from lower edge to edge of anterior median eyes being 1.35 mm.

Anterior median eyes rather less than their radius from each other; six times their diameter from the anterior laterals. Anterior row of eyes seen from above slightly recurved, a line tangent to caudal edges of median eyes being tangent to anterior edges of the laterals. Lateral eyes of each side equal in size and clearly larger than the anterior median eyes, a little less than their diameter apart, (Plate **9**, fig. 6).

Palpi lacking claw. Stridulating tubercles of palpus only four in number in specimen described. The stridulating plate of the chelicera, (Plate **9**, fig. 7). Palpi covered with stiff bristles like those of mandibles, etc.

Claws of legs curved; each with a single row of usually 12–13 teeth, (Plate **9**, fig. 10). The spines and bristles on legs and body with regular dark longitudinal ribs which under high magnification are seen to be serrated. The distal end of the spines is acute but that of the bristles is in the form of a crown of teeth, (Plate **10**, fig. 3).

Bristles on legs short and stiff, spinescent, arranged in regular rows, the spines inserted in line with the bristles. On the femora are two rows of bristles below and three rows above, the sides being covered with bristles irregularly arranged. Patellae with five less regular rows above, of which the three median rows are best developed; below with irregular bristles. Tibiae, metatarsi, and tarsi with two rows above, two on each side, and two below. Fine short hair between the rows on all the joints, (Plate **10**, fig. 2, 3).

The tibiae of all legs have six pairs of spines beneath and the metatarsi four or five pairs. On the anterior surface of tibiae I and II are five spines in lower row of bristles and four in the upper; tibia III has five in the lower and three in the upper; and tibia IV has four in the lower and one in the upper. On the posterior surface of tibia I there are six spines in the lower row of bristles and six in the upper; tibia II has six in the lower row and seven in the upper; and tibiae III and IV six in the lower and five in the upper. On the anterior surface of all metatarsi there are four spines in the lower row of bristles and four also in the upper. On the posterior surface of metatarsus I there are four spines in the lower row and four in the upper; on metatarsus II there are four and three respectively; on III five and three; and on IV, four and three.

Abdomen, (Plate **10**, fig. 1), covered with small scattered groups of short, curved, stiff bristles and over whole surface uniformly with very short hair.

Spinnerets small, dark brown, removed from end of abdomen in usual way. Colulus thin, pale, almost half as long as spinnerets.

Female. Length, 18.3 mm. Length of cephalothorax, 7.3 mm.; width, 7.6 mm.; width in front, 3.4 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	8 mm	10.5 mm.	5.8 mm.	3.8 mm.	28.1 mm.
Leg II	8.6	10.8	6.3	3.6	29.3
Leg III	8.5	10.0	5.7	3.8	28.0
Leg IV	8.2	9.8	5.8	3.8	27.6

Tibia I, 7.8 mm. Tibia IV, 7 mm.

Locality.— Santa Ana, 3,500 feet, August. (Type, M. C. Z. 165, female).

DYSDERIDAE.

Ariadna hotchkissi, sp. nov.

Plate **10**, fig. 4, 5.

Carapace dusky brown or fuscous, not adeolate. Sternum, chelicerae and coxae of palpi dusky, not areolate or only slightly so; labium darker, nearly black. Abdomen beneath dark grey; above obscurely mottled with partly confluent small areas of dusky purple, a more solid median longitudinal stripe at base; hairs long and short, numerous, dark.

Eyes large, the medians and laterals equal or very nearly so. Line formed by two anterior lateral eyes shorter than the posterior in ratio 17:15. Median eyes contiguous, their diameter or a little less from the laterals. Lateral eyes contiguous, (Plate **10**, fig. 4). Clypeus equal in width to the diameter of an anterior lateral eye or a little narrower.

Chelicerae short; smooth.

Labium nearly four fifths as wide as long; strongly narrowed distad; apically obtusely rounded, the proximal notches long, (Plate **10**, fig. 5).

Sternum long, the ratio of length to width being 85:53; caudal end obtusely angular.

Femur of leg I armed on anterior (inner) side with one large spine; patella unarmed; tibia armed ventrally with four pairs of uniform spines, not armed laterally; metatarsus armed ventrally with a double row of spines (6–6 or 6 + 7 in number) of which in each row the first three or four and the distal one are longer than the others. In leg II the femur and patella are unarmed; the tibia and metatarsus are armed like those of leg I. The femur and patella of leg III are also unarmed; the tibia is armed ventrally in the median line with two spines, one proximad of and one distad of the middle; the metatarsus is armed ventrally toward the caudal side with two spines, one median and one subbasal, and at distal end with three spines. Leg IV wholly unarmed as usual.

Female. Length 7 mm. Length of cephalothorax 2.8 mm.; width 2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2 mm.	2.6 mm.	1.3 mm.	.9 mm.	6.8 mm.
Leg II	1.8	2.2	1.2	.8	6.0
Leg III	1.7	1.8	1	.7	5.2
Leg IV	2	2.2	1	.8	6.0

Tibia I, 1.6 mm. long.

Locality.— Lucma, 7,000 feet, August. (Type, M. C. Z. 167, one female).

Named for H. Stuart Hotchkiss of New Haven, a patron of the expedition.

CAPONIDAE.

NOPS BELLULA, sp. nov.

Plate **10**, fig. 6–8; Plate **11**, fig. 1–3.

Carapace and sternum light orange-yellow; legs more lemon-yellow or with femora of legs I and II tinged with orange. Eyes on a black spot. Abdomen pale grey-green; dorsally at base with a small deep brown or blackish triangular spot of which the apex is cephalad, followed by a series of chevron marks of a color a little darker than that of the general surface, (Plate **11**, fig. 1).

Pars cephalica rather broader and less convex along anterior margin than in related species.

Clypeus slanting.

Eyes large; five sixths their diameter apart, a little less than three times their diameter (25:9) from lower edge of clypeus. Eye-tubercle rather low but distinct, (Plate **10**, fig. 7).

Sternum longer than wide in ratio 25:19; narrowing from middle caudad with the caudal end obtusely rounded, (Plate **10**, fig. 6).

Labium subcordate; distally acute; basal notches short, relatively deep; a little longer than wide, the ratio being about 17:16, (Plate **10**, fig. 8).

Coxae I and IV longer than others, subequal or I but slightly longer than IV. Trochanter IV longest, I next.

Claws of anterior legs with five long, stout teeth. An unpaired claw is present on anterior legs, this being rather long, parallel with paired claws, smooth. Membranous laminae below claws as in other species, (Plate **11**, fig. 3). Membranous appendage at base of anterior tarsi and the membranous keel beneath anterior metatarsi as in other species of the genus. All tarsi distinctly clavate excepting the fourth which is but slightly so and more slender. The division of tarsus most complete in fourth legs in which the parts are flexible at joint. Hairs of tarsus all simple, none clubbed as *e. g.*, in *coccineus*, (*Cf.* Plate **11**, fig. 2).

Inferior piece of lorum of pedicel as usual.

Inferior and median spinnerets in a recurved transverse row as in the other species. The superior spinnerets shorter than in most species, not so much exceeding those of the lower row.

Female. Length 6.7 mm.

	coxa	fem.	pat.	tib.	met.	tar.	total (excl. coxa)
Leg I	.76 mm.	1.6 mm.	.8 mm.	1.03 mm.	.84 mm.	.56 mm.	4.84 mm.
Leg II	.6	1.36	.8	.92	.8	.56	4.52
Leg III	.52	1.2	.68	.88	.8	.56	4.12
Leg IV	.72	1.6	.8	1.28	1.36	.72	5.76

Locality.— Ollantaytambo, 9,000 feet, July. (Type, M. C. Z. 168, one female).

This form differs from all other species of the genus, according to the published accounts, in having a large median claw on the anterior tarsi in addition to the paired membranous laminae. Simon, in discussing the Caponidae, says in regard to the inferior claw in this family (Hist. nat. Araign., 1, p. 325) "la griffe inferieure est assez petite et toujours mutique; chez les Nops elle est remplacée aux paires antérieures par deux petites lames membraneuses." But since in the case of the present species both the claw and the laminae are present at the same time, we cannot look upon the development of the laminae as such a replacing. The median claw is higher than usual in position, being inserted on a level with and lying between the paired claws so that it is easily overlooked; it is quite possible, therefore, that it will be found in some degree of development in other species. The superior spinnerets seem to be relatively considerably shorter than usual. The color-pattern of the abdomen is distinctive. In our present state of knowledge, it is impossible to give a wholly satisfactory judgment as to the position and relationships of the present form.

DRASSIDAE.

Drassodes sp.

An immature specimen of uncertain species was taken at Cuzco, 11,500 feet, in July. (M. C. Z. 169).

Drassodes araucanius,[1] sp. nov.

Plate **11**, fig. 4–8; Plate **12**, figs. 1–2.

Carapace light brown or testaceous; eyes, excepting sometimes the posterior medians, ringed with black and the intervening area in some dusky. Chelicerae brown to dilute chestnut. Sternum and endites like the carapace; labium dark dusky brown to dusky chestnut. Legs light brown or testaceous, the anterior pairs darker distally. Tarsus of palpus abruptly darker than proximal joints. Abdomen clear brown-grey without markings, paler beneath than above. Carapace clothed with numerous fine greyish hairs, a large proportion of which are plumose, with coarser, black, more erect hairs sparsely intermixed. Sternum densely clothed with similar mostly plumose hairs and sparsely with coarser, more bristle-like, black hairs. Legs clothed with finer appressed plumose grey hairs, more erect, stiffer simple grey hairs proportionately more numerous distad, and with numerous intermixed stiff black hairs. The abdomen is clothed with similar plumose grey pubescence and numerous longer stiff grey hairs with the black bristles more sparsely intermixed.

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[1] Araucania, a tribe of South American Indians.

Posterior row of eyes longer than the anterior in the ratio 63:53. Posterior row of eyes moderately procurved; median eyes placed very obliquely, subelliptic (ratio of axes 11:8), half of their smaller diameter apart, about twice their diameter from the laterals and their long diameter or a little more from the anterior medians; laterals with diameter smaller than long diameter of medians (9:11) and slightly exceeding the lesser diameter (9:8). Anterior row of eyes in dorsal view a little recurved, in anterior view considerably procurved; median eyes subequal to the laterals, their diameter apart and less than their radius (three fifths) from the laterals; eyes their diameter from lower margin of clypeus. Anterior lateral eyes somewhat larger than the posterior laterals from which they are separated by less than the diameter of the former, nearer together than the anterior and posterior medians. Area of median eyes equal in length and breadth, longer in front than behind in ratio 29:25, (Plate **11**, fig. 4).

Labium longer than wide in ratio 7:5; narrowing moderately distad, apically broadly obtusely rounded, (Plate **11**, fig. 6).

Sternum longer than wide in ratio 13:9. Acutely pointed caudad, (Plate **11**, fig. 5).

Leg I with femur above in median line with a distally bristle-like, but basally stout, subbasal spine and a submedian one, and with one on anterior side between middle and distal end; patella unarmed; tibia armed at distal end with one spine; metatarsus at base with two; metatarsus scopulate to base. Leg II with femur spined as in I with in addition a submedian one in line with the one on anterior surface and one in corresponding position on caudal side; patella unarmed; tibia ventrally with a distal and a submedian pair of spines and a single spine at base; metatarsus with a pair of spines at proximal end, scopulate to base. Leg III with femur spined as in II excepting for the addition of a subapical one (and sometimes a second one proximad of it) in the median dorsal line and another one in line with the one on the caudal side between middle and distal end, there being thus three or four median dorsal, two anterior, and two posterior spines; patella armed on the caudal side with one spine; tibia with three pairs of ventral spines, two in line on ventral part of anterior side, two in corresponding position on the posterior, one subdorsal on anterior side and one subbasal toward caudal side of dorsal surface; metatarsus with three pairs of ventral spines, two spines in line on caudal and two in line on dorsal surface, and two pairs (apical and submedian) on dorsal surface; metatarsus not at all scopulate. Leg IV with femur armed above in median line with two spines, on caudal side toward distal end above with one (or exceptionally two close together) spine and on anterior with two in line (the distal of which may be doubled); patella with one spine on caudal surface; tibia with three pairs of ventral spines, two in line on caudal surface and three on the cephalic, the most proximal of the latter more ventral in position; metatarsus with three pairs of ventral spines (or one spine absent from subbasal pair), two (apical and submedian) on cephalic side, and two pairs and a single subbasal spine on caudal side; metatarsus not at all scopulate. Claws of leg I with five slender teeth, (Plate **12**, fig. 2).

Female. Length 12 mm. Length of cephalothorax 5 mm.; width 3.8 mm.

	fem.	tib + pat.	met.	tar.	total
Leg I	3.6 mm.	4.4 mm.	2.1 mm.	1.3 mm.	11.4 mm.
Leg II	3	4.1	2	1.2	10.3
Leg III	3	3.2	2	1.2	9.4
Leg IV	3.7	5	3	1.9	13.6

Tibia I, 2.4 mm. Tibia IV, 3.1 mm.

Locality.— Cuzco, 11,500 feet, July 4. (Type M. C. Z. 170, female; paratypes, no. 171, females). Ollantaytambo, 9,000 feet, July. (M. C. Z. 327, several females).

APODRASSUS,[1] gen. nov.

Cephalothorax low, pars cephalica in profile descending moderately anteriorly, much narrowed in front; thoracic stria fine, distinct, moderate in length.

Eyes relatively large. Posterior row of eyes strongly procurved, the medians considerably farther from each other than from the laterals. Anterior row of eyes also rather strongly procurved; the medians the larger, widely separated from each other but very close to anterior and also to posterior laterals. Lateral eyes on each side subcontiguous. Clypeus narrow, its width not exceeding the radius of an anterior lateral eye.

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[1] 'από, away from, Drassus.

Labium wider than long.

Lower margin of chelicera with one tooth; upper with three of which the median is largest.

Legs slender; well spined; tarsi scopulate but not densely so.

Inferior spinnerets widely separated; median spinnerets moderate, cylindrical.

Genotype.—*Apodrassus andinus*, sp. nov.

Related to Leptodrassus Simon, but differing in the much narrower clypeus, more strongly recurved eye-rows, in having the posterior median eyes decidedly farther from each other than from the laterals, the tarsi moderately scopulate, and the inferior spinnerets widely separated instead of connivent.

APODRASSUS ANDINUS, sp. nov.

Plate **12**, fig. 3–8.

Carapace and legs light brown, the carapace and femora slightly dusky. Sternum and coxae of legs beneath clearer, more testaceous. Abdomen beneath light brown, above darker, dusky brown.

Posterior row of eyes very strongly procurved, a line tangent to the anterior edges of the medians being nearly tangent to the posterior edges of the laterals; medians elongate (axes to each other as 8:5), set very obliquely, separated by a distance equal to the lesser diameter, closer to the laterals about three fifths as far; lateral eyes a little larger than the medians (long diameters about as 9:8), about half their radius from the anterior laterals to which they are subequal in size. Anterior row of eyes scarcely longer than the posterior; in dorsal view a little procurved, in anterior view strongly so, a line tangent to lower edges of medians passing through caudal third of laterals; medians circular with diameter larger than the long diameter of the laterals (10:9), three fifths their diameter apart, much closer both to the anterior and the posterior laterals; laterals separated from lower edge of clypeus by a distance equal to their radius or a little less, the medians by about four fifths their diameter, (Plate **12**, fig. 5).

Sternum longer than wide in ratio 7:5 (Plate **12**, fig. 3).

Labium somewhat wider than long (nearly as 8:7); distad of proximal third broadly, almost semicircularly rounded, but distally a little depressed, (Plate **12**, fig. 6).

Tarsi III and IV a little curved, I and II straight. Anterior tarsi not densely scopulate, the scopular hairs of tarsi III and IV more sparse; metatarsi I and II with a few scopular hairs extending nearly to base, III and IV without any. Scopular hairs very broad and strongly clavate. Leg I with femur bearing two long spines in middorsal line (between middle and base and middle and distal end respectively) and one on anterior surface between middle and distal end; tibia with three pairs of ventral spines; metatarsus with one subbasal pair. Leg II with spines same as those of I. Leg III with femur bearing three spines along middorsal line, two on anterior side and two on posterior side; patella with a spine on anterior and also one on posterior surface; tibia on ventral surface with a pair of spines at distal end and two single ones in line more proximad, two on anterior and two on posterior surface, and one subbasal one on dorsal surface; metatarsus on ventral surface with a distal pair and three (or four?) more proximal ones rather irregularly arranged, a spine at distal end on each side and dorsally a median distal one, a submedian pair and a single subbasal one. Leg IV with femur armed with three spines along middorsal line, two on anterior side and one on posterior; patella with a spine on anterior and one on posterior side; tibia with two pairs of dorsal spines, the anterior spine of each pair much smaller than the caudal one, ventrally with one distal pair, a submedian pair and a single subbasal spine; metatarsus with two pairs of dorsal spines, (between middle and base and middle and distal end respectively), three on anterior side and two on posterior, on ventral surface with two at distal end, one toward middle and one toward base. Claw of leg I with seven long teeth, (Plate **12**, fig. 7).

Inferior spinnerets widely separated, more than their diameter apart; spinning tubules very large, arranged in a semicircle.

Spermatheca large, broadly fusiform, densely chitinized and dark in color, showing distinctly through surface integument, the openings small. The integument over the spermatheca in type is torn so that its precise configuration cannot be made out, but its modifications seem to be very slight, (Plate **12**, fig. 8).

Female. Length 6.2 mm. Length of cephalothorax 2.5 mm.; width 2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.1 mm.	2.4 mm.	1.6 mm.	1.1 mm.	7.2 mm.
Leg II	1.9	2.35	1.6	1.1	6.95
Leg III	1.65	2.0	1.4	.9	5.95
Leg IV	2.25	2.85	2.25	1.1	8.45

Tibia I, 1.55 mm. Tibia IV, 1.8 mm.

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 172, female).

PHOLCIDAE.

HYPSORINUS,[1] gen. nov.

Eyes elevated on a tubercle. Anterior row of eyes strongly recurved; median eyes with radius one third more or less than that of the laterals, near together and only about their radius from laterals. Posterior row of eyes a little procurved, the space between medians in type only one and a third times their long diameter. Area of median eyes trapeziform, clearly longer than posterior width.

Abdomen short, strongly elevated, and in type distinctly higher than long.

Legs in both sexes without spines.

Chelicera in male with a short stout tooth near base of claw on upper surface, (Plate **14**, fig. 3).

Tarsus of palpus much longer than the tibia; pointed distad but not abruptly more slender than tibia.

Genotype.— *Hypsorinus binghamae*, sp. nov.

This genus is most closely related to Smeringopus of Simon from which it is here separated chiefly because of the following differences:— the abdomen is high and subglobose instead of elongate and slenderly cylindrical; the tarsus of the female palpus is much longer than the tibia instead of abruptly much shorter and more slender; and the posterior row of eyes is procurved instead of recurved, while the anterior median eyes are much closer to the laterals.

HYPSORINUS BINGHAMAE, sp. nov.

Plate **13**, figs. 1–9; Plate **14**, figs 1–7.

Carapace and sternum very light greyish brown, a darker median longitudinal stripe narrowing up the clypeus over the eye-area and thoracic groove to the caudal margin where it is reduced to a mere line, the carapace elsewhere with scattered small dark dots. Legs dilute testaceous to nearly grey; femora toward distal end with two darker, somewhat reddish brown, annuli incomplete dorsally and with more indistinct dark cross-marks more proximad; patellae with a dark annulus over most of length; tibiae with three annuli, one subbasal, one distad of middle, and one distal or with the dark color more diffused and no distinct annuli indicated. Abdomen dull grey, more or less closely mottled with very small, not strongly contrasting, silver spots, a clear narrow median stripe free from spots extending three fourths the distance to the caudal end; on each side of median stripe two or more pairs of dark dots of which one pair near the caudal and one near the anterior end are more conspicuous.

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[1] ὕψος, top, ʼορεινός, mountaineer.

Eye-tubercle conspicuous, subdivided by a y-shaped furrow with the branches cephalad, the tubercle between them bearing the anterior median eyes and each lateral tubercle bearing two lateral and the one posterior median eye of the corresponding side. Anterior row of eyes strongly procurved both in dorsal and in anterior view as in Smeringopus; median eyes much smaller than laterals the diameter of which is somewhat more than 1.5 times greater, less than their radius apart and only their radius from the laterals. Posterior row of eyes a little procurved; median eyes smaller than the laterals (ratio of long diameters near 5:6), very close to laterals, once and a third their long diameter apart. Lateral eyes equal or nearly so, their radius or a little less apart. Area of median eyes in dorsal view trapeziform, narrower in front than behind in about ratio 25:43, longer than greatest width (ratio 7:6), (Plate **13**, fig. 2).

Clypeus high, nearly twice as high as length of median eye area.

Cephalothorax convex and very high. Thoracic groove very deep, radial impressions distinct. Pars cephalica small, not elevated.

Sternum wider than long nearly in ratio 3:2.

Labium large, convexly rounded at tip, (Plate **13**, fig. 3).

Paired claws with eight to twelve long teeth, (Plate **14**, fig. 5). Unpaired claw with a single long tooth, (Plate **13**, fig. 7). Bristles of legs with slender teeth near base, mostly two to four in number on one side but one or more may also be present on the other, while in a number near the claw the number of branches or teeth is much larger, (Plate **13**, fig. 9; Plate **14**, fig. 2). A feather-hair, of which a pair occur near claw of leg I, is represented, (Plate **14**, fig. 1).

The abdomen is distinctly higher than long. The spinnerets are borne considerably farther forward beneath abdomen in the female than in the male, (*cf*. Plate **13**, fig. 1).

Male (Type). Length 5.5 mm. Length of cephalothorax 2.3 mm.; width, 2.4 mm.

	fem.	tib.+pat.	met.
Leg I	10.8 mm.	12.2 mm.	16.2 mm.
Leg II	8.2	8.8	11.0
Leg III	6.5	7.0	8.8
Leg IV	9.0	9.0	11.8

Female. Length 5.5 mm. Length of cephalothorax 2.2 mm.; width 2.4 mm.

	fem.	tib.+pat.	met.
Leg I	10.8 mm.	11.8 mm.	14.5 mm.
Leg II	7.8	8.0	10.0
Leg III	6.3	6.3	8.2
Leg IV	8.8	8.8	11.0

(Because of the curling of the tarsi it is very difficult to determine their lengths accurately, so these are not given above).

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 173, male; paratypes, M. C. Z. 174, one adult female and two immature specimens).

Named for Mrs. Alfreda Mitchell Bingham.

LITOPORUS ABERRANS, sp. nov.

Plate **14**, fig. 8, 9; Plate **15**, fig. 1–3.

Carapace dilute yellow, a deep brown or blackish median band extending from caudal margin across eye-area and down the clypeus to its lower edge, this band widening up the posterior declivity but of uniform width in front of this, enclosing a narrow paler longitudinal area between the eyes; a dark band extends on each side from the caudal end of the median band along the margin ectad and forward some distance in front of middle of length. Sternum brown, paler along borders. Legs brown, the femora each with a black annulus at distal end set off by a light ring adjacent to it on its proximal side, also somewhat darker at proximal end; patella dark; tibia with a dark annulus at each end; other joints not ringed. Abdomen with ground color whitish; above weakly suffused with blue and with deeper solid blue spots in a row each side of a middle stripe the row curving ectad at caudal end and not attaining the posterior end of abdomen; on each side a few less deeply colored spots; caudal surface of abdomen with a large dark area of continuous dilute blue closely covered with deeper blue spots, this area reaching to the spinnerets; ventrally there is a moderately large quadrate area of brown in the genital region.

Posterior row of eyes with median eyes essentially contiguous with the laterals as usual, separated from each other by a distance somewhat greater than their diameter (9:7), smaller than the laterals (diameters as 7:10) which are about equal to the anterior laterals. In dorsal view the anterior row of eyes is distinctly procurved; in anterior view by their centres they are strongly procurved but with upper edges in a straight line; the median eyes are nearly contiguous, separated by a distance clearly less than their radius, separated from the laterals by a distance greater than their radius but less than their diameter, (Plate **15**, fig. 1).

Chelicera of male without the usual tooth on the anterior face and also lacking a true carina toward base; inner chitinous edge bent outward at clypeal margin and showing as a dark chitinous line or ridge.

Labium broad, distally truncate, (Plate **14**, fig. 8).

Sternum wider than long in ratio 6:5; the wide caudal margin between coxae of fourth legs convex, (Plate **14**, fig. 8).

Male. Length 4 mm. Length of cephalothorax 1.5 mm. (to edge of clypeus); width 1.4 mm.

	fem.	tib.+pat.	met.
Leg I	5.2 mm.	6 mm.	6.2 mm.
Leg II	4.2	4.2	4.3
Leg III	3.2	3.1	4
Leg IV	4.6	5.	5

Locality.— Urubamba, 9,500 feet, July. (Type, M. C. Z. 175, one male).

Aberrant in its genus in lacking any distinct tooth or true carina on anterior face of chelicera but in other respects apparently conforming to the genus in its typical form. The abdomen is higher than usual.

THERIDIIDAE.

ARGYRODES VITTATUS Keyserling.

Spinnen Amerikas. Theridiidae, 1884, **2**, pt. 1, p. 191, pl. 9, f. 114.

One female of this species from San Miguel, 6,000 feet, July. (M. C. Z. 176).

ARGYRODES LUCMAE, sp. nov.

Plate **15**, fig. 4–6.

Carapace pale yellow. Sternum dusky brown or blackish. Labium blackish, pale across tip. Endites yellowish with some dusky markings. Legs pale yellow or, especially the caudal pairs, proximally whitish. Abdomen covered with scales of shining silver over a pale yellow ground.

Abdomen moderately elongate; roundly elevated above toward base, (Plate **15**, fig. 5).

Posterior row of eyes straight or very nearly so; medians about five sevenths their diameter apart, a little closer to the somewhat smaller laterals (6:7). Lateral eyes contiguous, subequal. Anterior row of eyes straight; medians their radius or slightly more apart, about half as far from the laterals which are smaller (diameters about as 6:7). Clypeus slightly narrower than the diameter of a median eye.

Labium wider than long (*cir.* 4:3); sides but little convex and moderately converging distad; distally widely truncate.

Sternum broadest across anterior end, rounded caudad and extended as a slender acute process between the fourth coxae; total length to the width about as 9:8, (Plate **15**, fig. 4).

Male. Length 3.8 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	5 mm.	6.2 mm.	7 mm.	1.6 mm.	19.6 mm.
Leg II	3.2	3.7	3	1.1	11.0
Leg III	2.6	2.5	2	.9	8.0
Leg IV	3	2.2	2.3	1.0	8.5

Tibia I, 5.8 mm.

Locality.— Lucma, 7,000 feet, August. (Type, M. C. Z. 177, one male).

THERIDION sp. a.

A young female of doubtful species from Lucma, 7,000 feet, August. (M. C. Z. 178).

THERIDION sp. b.

An immature female from the Conservidayo River, August. (M. C. Z. 179).

THERIDION TOSUM,[1] sp. nov.

Plate **16**, fig. 1–4.

Carapace and chelicerae pale testaceous; sternum, labium, and endites yellow; legs yellow except proximally above where similar to carapace; all these parts without special markings. Abdomen grey, a longitudinal wavy white line on each side of middle of dorsum the two lines converging to spinnerets; a few small light dots between the wavy lines caudally; otherwise the abdomen is unmarked.

Posterior row of eyes substraight or slightly recurved; eyes nearly equidistant, the medians being about their diameter apart and the same distance or slightly farther from the laterals. Posterior lateral eyes equal to the anterior laterals or very nearly so. Anterior row of eyes in front view straight; median eyes slightly smaller than laterals, to which they are closer than to each other, more than their diameter apart. Area of median eyes equal in width in front and behind, equal in length and breadth or slightly wider, (Plate **16**, fig. 3).

Labium wider than long as usual; distally widely semicircularly rounded, (Plate **16**, fig. 1).

Sternum longer than wide in ratio 6: 5, more narrowly attenuated, and rounded caudad than, *e. g.*, in the succeeding species, (Plate **16**, fig. 2).

Anterior paired claw of leg IV with four teeth of which the most distal is very long and reaches about the same level as tip of claw; teeth of other claw shorter. Unpaired claw untoothed.

Female. Length 4.3 mm. Length of cephalothorax, 2 mm.; width, 1.47 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.3 mm.	2.9 mm.	1.9 mm.	.9 mm.	8.0 mm.
Leg II	2	2.1	1.5	.7	6.3
Leg III	1.9	1.5	1.0	.6	5.0
Leg IV	2.9	2.2	1.9	.8	7.8

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 180, one female).

THERIDION LEGUIAI, sp. nov.

Plate **15**, fig. 7–10.

Carapace on sides obscure olive-white, a broad black median longitudinal band over clypeus and eye-area and narrowing from there caudad down posterior declivity of cephalothorax; lateral borders also black, the lateral bands confluent with the median one in front; clypeal margin pale. Sternum testaceous, broadly bordered with black. Labium and endites blackish. Chelicerae testaceous in front, darker, chestnut, distally. Legs black, conspicuously annulate with yellow or testaceous; femora with a broad light band proximally and a narrower one toward distal end; patellae with one subdistal annulus; tibiae with an annulus at proximal end and one between middle and distal end; metatarsi with annuli corresponding to those of tibiae; tarsi entirely light or light at the ends. Abdomen black; on dorsum toward caudal end in median line a row of three small light dots and in front of these two pairs of separated oblique light marks of which the anterior send a slender branch forward. Hairs of abdomen short, numerous.

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[1] Gosiute *tosibit*, *tosa*, white or light colored.

Posterior row of eyes a little procurved; median eyes only slightly elongate and oblique, about seven tenths their longer diameter apart and nearly the same distance from the laterals; laterals equal in size to the medians, larger than the anterior laterals with which they are contiguous. Anterior row of eyes in dorsal view strongly recurved, the median eyes being carried considerably forward as usual, larger than the laterals (diameters as 11:7), a little more than their radius apart (six elevenths of diameter), only half as far from the laterals; in front view the row is straight or nearly so. Area of median eyes subquadrate, being very slightly wider in front than behind. Chelicerae much longer than the height of the clypeus, (Plate **15**, fig. 8).

Labium wider than long in ratio 22:13; distally widely truncate.

Sternum subtriangular; longer than wide in ratio 6:5.5; caudal process obtusely rounded, (Plate **15**, fig. 7).

Paired claw of leg I with seven or eight teeth of which the proximal ones are very short, (Plate **15**, fig. 9).

Abdomen subglobose, smoothly rounded, with no irregularities or tubercles.

Female. Length, 5.1 mm. Length of cephalothorax, 2.2 mm.; width, 1.85 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	3.6 mm.	4 mm.	3 mm.	1.3 mm.	11.9 mm.
Leg II	2.3	2.8	2	1.2	8.3
Leg III	2	2	1.3	1	6.3
Leg IV	3.1	3	2.2	—	—

Locality.— Conservidayo River, August. (Type, M. C. Z. 181, one female).

Named for Mr. A. B. Leguia, former President of Peru.

GARRICOLA,[1] gen. nov.

Cephalothorax broadly ovate, much narrowed cephalad; front narrow, convex. Thoracic furrow transverse, wide, recurved.

Eyes of the posterior row procurved; subequal; the medians farther apart than from the laterals from which they are separated by much less than their diameter. Anterior eyes subequal, in a strongly procurved row, medians well separated but very close to the laterals. Area of median eyes quadrate, of equal width anteriorly and posteriorly.

Sternum as wide as or wider than long; posteriorly obtuse, with the coxae rather widely separated.

Labium not free; much wider than long, distally narrowed, convex.

Endites bent, conspicuously converging over labium which extends rather beyond the middle of their length.

Legs slender, of moderate length, clothed with slender bristles. Teeth of claws few, divaricate.

Genotype.— *Garricola sanctus*, sp. nov.

GARRICOLA SANCTUS, sp. nov.

Plate **16**, fig. 5, 7.

Carapace and sternum dilute yellow. Legs dilute yellow, dusky especially distad. Abdomen grey.

Cephalothorax broad, subcircular in outline caudad, strongly narrowed cephalad. Eye-tubercle elevated. Thoracic furrow transverse, broad, recurved, (Plate **16**, fig. 5).

Posterior row of eyes distinctly procurved; medians a little larger than the laterals, about three fourths their long diameter apart and about their radius from the laterals. Lateral eyes contiguous, scarcely differing in size. Anterior median eyes three fourths their diameter apart and about one half their radius from the laterals, which are of an equal size or nearly so; anterior row of eyes strongly procurved. Area of median eyes equal in length and breadth, of same width anteriorly and posteriorly; clypeus lower than length of chelicerae and a little wider than length of median eye-area (6:5), oblique, slanting cephalomesad.

Sternum convex and prominent; wider than long (10:9); broad anteriorly and triangularly narrowing caudad, but truncate between the widely separated fourth coxae, (Plate **16**, fig. 6).

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[1] Gosiute *garri*, mountain range, *cola*.

Labium not free; distally strongly convexly rounded; much wider than long (*cir.* 7:4).

Abdomen subglobose. Spinnerets terminal, (Plate **16**, fig. 5).

Bristles in comb of fourth tarsus eight or nine in number. Teeth of claws few, divaricate.

Epigynum proportionately large, (Plate **16**, fig. 7).

Length of female, 3 mm.

Locality.— San Miguel, 6,000 feet, July. (Type, M. C. Z. 182, one female).

LATRODECTUS MACTANS (Fabricius).

Aranea mactans Fabr., Ent. syst., 1775, **2**, p. 410.

A species occurring widely in the western hemisphere from New England to Terra del Fuego.

Localities.— Ollantaytambo, 9,000 feet, July 21. (M. C. Z. 183, five females and one male). Cuzco, 11,500 feet, July 12. (M. C. Z. 184, two females).

LITHYPHANTES NIGROFEMORATUS Keyserling.

Spinnen Amerikas. Theridiidae, 1884, **2**, pt. 1, p. 139, pl. 6, f. 87.

A species previously known from Monterico in Peru and from Guatemala.

Localities.— Huadquina, 5,000 feet, July. (M. C. Z. 185, one female). Cuzco, 11,500 feet, July. (M. C. Z. 186, one female).

ENOPLOGNATHA sp.

A young female of uncertain species from Tincochaca, 7,000 feet, July. (M. C. Z. 187).

ENOPLOGNATHA PERUVIANA, sp. nov.

Plate **16**, fig. 8–11; Plate **17**, fig. 1–2.

Carapace and legs light brown or testaceous; sternum darker, of somewhat chestnut cast. Abdomen over anterior and caudal ends and over upper part of sides dark, somewhat greyish black, a wavy or zig-zag light line dividing the dark along the upper part of the dark area of each side; dorsum light, the light area divided by a median longitudinal stripe formed by two contiguous triangular areas of which the apices are cephalad; lower portion of sides lighter, crossed by several more or less obscure light lines; median portion of venter dark, a light longitudinal line on each side. Spinnerets light testaceous or yellow.

Posterior row of eyes a little procurved; median eyes much the largest of all, elongate, long axis paralled with that of body, only about one third their long diameter apart, much farther, about four fifths their diameter, from the laterals; laterals about one third their diameter from the anterior laterals which are considerably smaller. Anterior row of eyes straight; median eyes distinctly smaller than the laterals (diameters about as 11:13), their radius apart and only their diameter from the laterals. Area of median eyes longer than wide (9:8), wider behind than in front not quite as 8:7, (Plate **17**, fig. 1).

Labium as usual much wider than long (ratio 11:8); semi-circularly rounded distad, (Plate **17**, fig. 2).

Sternum subtriangular, narrowed caudad to a slender process extending between coxae of last legs, (Plate **16**, fig. 8).

Paired claws with numerous long teeth, the tips of which are in a straight line, these on leg I numbering ten or eleven, (Plate **16**, fig. 9). Unpaired claw with a single small denticle, (Plate **16**, fig. 10).

Female. Length, 8 mm. Length of cephalothorax, 3 mm.; width 2.4 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	3 mm.	3.6 mm	2.2 mm.	1 mm.	9.8 mm.
Leg II	2.6	3	2	.9	8.5
Leg III	2.3	2.9	1.8	.9	7.9
Leg IV	3.1	3.6	2.2	1.2	10.1

Locality.— Urubamba, 9,500 feet, July. (Type, M. C. Z. 188, female; paratype, M. C. Z. 189, 2 females).

ENOPLOGNATHA DUBIA, sp. nov.

Plate **17**, fig. 3.

Carapace dilute testaceous, a blackish median longitudinal stripe over stria thoracica, this becoming wider and more dilute cephalad toward eyes; lateral margins dusky. Sternum dusky testaceous, more blackish caudad. Labium blackish; endites paler, testaceous, Legs testaceous; the femora with three wide dusky annuli; patellae dusky around distal end and tibiae with three dark rings, the annuli of all joints most distinct on anterior legs. Abdomen somewhat pale testaceous over sides; above a narrow, solid black, foliate mark over entire length, the edges wavy and bordered on each side by a distinct white line; venter with a black longitudinal stripe over entire length which narrows somewhat from anterior end caudad.

Posterior row of eyes straight; median eyes a little smaller than the laterals diameters about as 7:8), a little less than their diameter apart and a little more than their diameter from the laterals. Lateral eyes contiguous, subequal. Area of median eyes of nearly equal length and breadth; of same width in front as behind. Anterior row of eyes straight; median eyes their diameter apart, considerably nearer to the laterals (near their radius). Clypeus of nearly same width as area of median eyes, but not much more than half as wide as the length of the chelicerae.

Labium about three fourths as long as wide; the distal margin convex.

Sternum not quite five sixths as wide as long; process between posterior coxae distally rounded, not acute.

Female. Length, 5.2 mm. Length of cephalothorax, 2 mm.; width, 1.6 mm.

Locality.— Sorontoy, 7,000 feet, September. (Type, M. C. Z. 190, one female).

LINYPHIIDAE.

ERIGONE TAIBO,[1] sp. nov.

Plate **17**, fig. 5.

Carapace, sternum, mouthparts, palpi, and legs brownish black. Abdomen yellowish white; epigynum and spinnerets blackish.

Posterior row of eyes a little recurved; eyes equidistant, the medians one and two thirds their diameter apart. Lateral eyes contiguous, the anterior the larger. Area of median eyes wider behind than in front in the ratio 10:7; about equal in length and greatest width.

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[1] Gosiute *taibo*, a white person.

Anterior row of eyes slightly procurved; median eyes two thirds their diameter apart, one and two thirds or more their diameter from the laterals; median eyes nearly four times their diameter from lower margin of the clypeus.

Carapace smooth; not marginally dentate.

Lower margin of furrow of chelicera with three or four teeth of which the one nearest the claw is double or bifid.

Length of female 3.5 mm.

Locality.— Urubamba, 9,500 feet, July. (Type, M. C. Z. 191; paratypes M. C. Z. 192, three females).

ERIGONE NIWINA,[1] sp. nov.

Plate **17**, fig. 4.

Carapace, sternum, and coxae of legs light red or dilute chestnut. Legs distad of coxae dusky brown or blackish. Entire abdomen grey-black.

Carapace smooth.

Posterior row of eyes straight; median eyes their diameter apart, a little farther from the laterals (*cir.* one and a fifth). Lateral eyes on each side subcontiguous, the anterior distinctly the larger. Area of median eyes wider behind than in front in the ratio 11:7; slightly longer than the greatest width (12:11). Anterior row of eyes slightly procurved; median eyes smaller than the laterals in about ratio 3:4, two thirds their diameter apart, one and two thirds their diameter from the laterals and four times their diameter from the lower margin of clypeus.

Sternum of the usual general form; equal in length and breadth or slightly wider.

Upper margin of furrow of chelicera typically with a triple or trifid tooth nearest claw and two isolated teeth; lower margin with five teeth.

Epigynum of same general form as that of *E. taibo*, (Plate **17**, fig. 4).

Length of female 3.5–4 mm.

Locality.— Urubamba, 9,500 feet, July. (Type, M. C. Z. 193, female; paratype, M. C. Z. 194, one female).

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[1] Gosiute *niwina*, an Indian.

OEDOTHORAX MELACRA,[1] sp. nov.

Plate **17**, fig. 6, 7.

Carapace and legs light brown or the latter somewhat more yellowish, the former dusky anteriorly and along lateral edges. Sternum black. Abdomen typically pink, more rarely brown of only faint pinkish tinge; tip of abdomen about bases of spinnerets black; epigynum black.

Posterior row of eyes straight; eyes equal in size; median eyes but little more than their radius apart, three fourths their diameter from the laterals. Lateral eyes contiguous, equal in size or the anterior, but slightly larger. Anterior row of eyes straight or very slightly recurved; median eyes with diameter three fourths that of the laterals, not fully their radius apart, two thirds their diameter from the laterals, three times their diameter from the lower edge of clypeus. Area of median eyes wider behind than in front in ratio 10:7.

Carapace of male smooth, without processes.

Chelicera of male with a rather long, acute process or tooth near middle of length on anterior side, this directed anteroventrad.

Sternum with process between posterior coxae with sides convex, the process widening a little distad of its middle and distally truncate.

Tibia with two spines on outside at distal end on a common base.

Locality.— Cuzco, 11,500 feet, July. (Type, M. C. Z. 195, male; paratypes M. C. Z. 196, three females).

OEDOTHORAX ORINUS,[2] sp. nov.

Plate **17**, fig. 8.

Carapace and legs light brown. Sternum dusky. Abdomen dark grey; a median longitudinal black line; caudal portion with several black chevron-marks of which the more anterior are crossed by the median line.

Carapace smooth, without teeth.

Posterior row of eyes very slightly procurved; eyes subequal; median eyes three fifths their diameter apart and the same distance, or very nearly so, from the laterals. Lateral eyes on each side con-

[1] *μέλας* black, *ἄκρα*, tip.

[2] *'ορεινός*, mountaineer.

tiguous, equal. Quadrangle of median eyes wider behind than in front in the ratio 6:5, equal in length and breadth or scarcely longer. Anterior row of eyes straight or but very slightly recurved; median eyes smaller than the laterals (diameters about as 4:5), one fourth their diameter apart, their radius from the laterals, two and a half times their diameter from the lower margin of the clypeus.

Sternum equal in length and width or slightly wider; the intercoxal caudal process narrow.

Upper margin of furrow of chelicera typically with four teeth of which the three nearest the claw are long and conical or with the one nearest claw smaller, the fourth much smaller than others; sometimes only three teeth of which the one nearest claw may be bifid.

Locality.— Cuzco, 11,500 feet, July. (Type, M. C. Z. 197, female; paratypes, M. C. Z. 198, two females).

TUTAIBO,[1] gen. nov.

Cephalothorax short; broadly ovate; frons obtuse and moderately wide.

Posterior row of eyes substraight or weakly recurved; median eyes farther apart than from the laterals, distinctly more than their diameter apart. Anterior row of eyes decidedly procurved, its eyes subequidistant. Area of median eyes wider than long and wider behind than in front.

Legs slender; anterior tarsi shorter than the metatarsi.

Frons without special process in the male.

Tibia of palpus in the male with a conspicuous dorsal spine.

Genotype.— *Tutaibo debilipes,* sp. nov.

TUTAIBO DEBILIPES,[2] sp. nov.

Plate **17**, fig. 9–10.

Carapace and sternum black. Legs black or blackish brown, somewhat paler distally. Abdomen entirely shining black.

Posterior row of eyes slightly recurved; median eye a little more than once and a half their diameter apart, only about their diameter from the laterals. Lateral eyes on each side elevated on a common tubercle, contiguous, subequal. Quadrangle of median eyes wider behind than in front in the ratio 13: 11, and wider than long in the same ratio or nearly so. Anterior row of eyes conspicuously procurved; eyes subequal; median eyes two thirds their diameter, or slightly more, apart and the same distance from the laterals, three and a half times their diameter from lower margin of clypeus (male).

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[1] Gosiute *tutaibo*, a negro.

[2] *debilis*, feeble, *pes*, foot.

Sternum with process between posterior coxae moderately wide, the distal margin a little incurved.

Tibia of male palpus with a stout, acutely pointed, subconical process from dorsal surface near the proximal end.

Length of male 2.2 mm.; of female, 3 mm.

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 199, male; paratypes M. C. Z. 200, one male, five females).

ARGIOPIDAE.

TETRAGNATHA TINCOCHACAE, sp. nov.

Plate **18**, fig. 2, 3.

Carapace and chelicerae yellowish, a black marginal line on each side and a dusky median longitudinal stripe which widens and becomes more diffuse upon the head. Sternum dusky brown or blackish. Legs yellow, either unmarked or with femora and tibiae of anterior pairs darker at distal ends and patellae also more or less darkened. Ground color of abdomen silvery white as usual, overlaid with a network of dark lines; venter with a median longitudinal brown stripe; a narrow black stripe along each side expanded near its middle into a larger spot; typically with a fine more or less broken longitudinal black line on each side of dorsum just above the lateral stripe; dorsum with a median longitudinal grey line giving off side branches as usual.

Posterior row of eyes (in female) conspicuously recurved as usual; median eyes twice their diameter apart, nearly same distance from the laterals. Lateral eyes separated by about their diameter, their tubercles touching at base. Area of median eyes wider behind than in front in ratio 6: 5; shorter than wide (5: 6), the length equalling the width at anterior end. Anterior row of eyes recurved; median eyes equal to the posterior medians or scarcely smaller, once and a half their diameter apart and twice their diameter or more from the laterals.

Chelicera of male with fang having a nodule or cusp at base; the conspicuous dorsal spine well removed from the line of teeth; upper row of teeth with the second tooth from claw; the large tooth, conspicuously long and stout, six teeth proximad of large tooth. Tooth nearest fang on lower margin the largest, the second small. Chelicera of female lacking the dorsal spine; teeth of upper margin similar to those of the male but the tooth nearest fang more reduced and the "big" tooth shorter, (Plate **18**, fig. 2).

Legs with rather numerous spines on the femora, these equal in length to diameter of joint or but little longer; spines of more distal joints fewer but proportionately longer.

Male. Length 6.1 mm. Length of cephalothorax 2.1 mm.; width, 1.4 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	6 mm.	6.8 mm.	5.8 mm.	1.8 mm.	19.4 mm.
Leg II	4.2	4.2	3.6	1.1	13.1
Leg III	2.3	1.6	1.5	.9	6.3
Leg IV	4	3.3	3	1.1	11.4

Locality.— Tincochaca, 7,000 feet, August. (Type, M. C. Z. 201, male; paratypes, M. C. Z. 202, three females).

TETRAGNATHA SCOPUS,[1] sp. nov.

Plate **18**, fig. 1.

Carapace and chelicerae light brown to testaceous. Legs brownish yellow to yellow. Sternum from dusky yellow to dusky brown. Abdomen with ground-color silver-white covered with a fine network of grey. A longitudinal band over the venter in which the light dots are much reduced and almost obliterated limited on each side by a more silvery line on the outside of which is typically an irregular line of dark grey or blackish. Dorsum of abdomen lighter than sides and venter; a middorsal longitudinal grey line presenting several uneven pairs of branches extending in a caudoectal direction, in most specimens a large dark brown or black spot on each side near middle of length contiguous with a dark stripe along each side.

Abdomen conspicuously broadened and gibbous in front; about 2.7 times longer than the greatest width; dorsal line convex.

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[1] σκοπός, a watcher.

Posterior row of eyes recurved as usual; median eyes near two and two fifths their diameter apart and about the same distance from the laterals. Lateral eyes their diameter apart, their tubercles in contact at base. Anterior row of eyes slightly procurved; median eyes once and a half their diameter apart, twice their diameter from the laterals. Area of median eyes much wider behind than in front (ratio 5:4).

Upper margin of furrow of chelicera with six (or five) teeth of which the one nearest the claw is much the largest; this separated from the second by a wide space, the second, third, and fourth about equal in size and spacing, the two most proximal smaller. Lower margin with four teeth equally spaced but with the first considerably largest as in the upper row, (Plate **18**, fig. 1).

Legs with the spines of the distal joints long, slender, and subappressed, clearly longer than in the succeeding species, *T. quechua.*

Female. Length 7.7 mm. Length of cephalothorax 2 mm.; width 1.6 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	4.9 mm.	5.1 mm.	4.2 mm.	1.2 mm.	15.4 mm.
Leg II	3.2	3.3	3.8	1	11.3
Leg III	1.7	1.7	1.2	.6	5.2
Leg IV	3.1	3	2.2	1	9.3

Tibia I, 4.2 mm. Tibia IV, 2.3 mm.

Locality.— Conservidayo River, August. (Type, M. C. Z. 203, female; paratypes, M. C. Z. 204, numerous specimens, chiefly immature males and females).

TETRAGNATHA QUECHUA,[1] sp. nov.

Plate **18**, fig. 4.

Carapace and chelicerae light brownish yellow. Sternum somewhat dusky yellow. Legs yellow, femora, and tibiae darker at the distal ends but legs not truly annulate. Abdomen above silvery white in numerous spots separated by a close network of fine grey lines; a median longitudinal grey line throughout length, this widest at the anterior end and giving off a principal pair of branches in a caudolateral direction at about one fourth length from anterior end; on caudal half on each side a row of four moderately large dark dots. Venter of abdomen with ground-color and network like dorsum but darker; a narrow median longitudinal stripe solid grey, a darker line along border of venter on each side.

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[1] The Quechuas are the indigenous people of Peru and Ecuador.

Posterior row of eyes strongly recurved; median eyes about two and one fifth their diameter apart and about three times their diameter from the laterals. Lateral eyes on each side separated by their diameter, their tubercles distinct but contiguous at base or nearly so. Anterior row of eyes recurved as usual; median eyes equal in size to the posterior medians, one and a fifth their diameter apart and more than three times their diameter from the laterals. Area of median eyes much wider behind than in front, the ratio being 11:9, slightly wider than long.

Upper margin of furrow of chelicera in female with nine teeth; of these the first and third from the fang are the largest and are separated by a wide space in which the much smaller second tooth lies, (Plate **18**, fig. 4). Teeth of lower margin with nearly the same arrangement as those of the upper.

Abdomen long and slender, somewhat more than four times longer than the greatest width, narrowly rounded caudad and gradually widening cephalad; anterolateral corners subrectangular, not gibbous.

Legs with few spines of which those on femora are shorter than the diameter of the joint and those on the more distal joints are longer. Hairs more numerous on distal joints, somewhat oblique, of moderate length.

Female. Length 11 mm. Length of cephalothorax 3 mm.; width, 1.9 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	8.1 mm.	9.6 mm.	9.1 mm.	2.1 mm.	28.9 mm.
Leg II	5.3	5.3	5	1.5	17.1
Leg III	3.1	2.2	2.2	1	8.5
Leg IV	5.6	5.6	5	1.3	17.5

Tibia I, 8.8 mm. Tibia IV, 4.8 mm.

Locality.— Sorontoy, 7,000 feet, September. (Type, M. C. Z. 205, female).

TETRAGNATHA sp.

Locality.— San Miguel, 6,000 feet, July. (M. C. Z. 328, immature).

LEUCAUGE MARIANA (Keyserling).

Meta mariana Keyserling, Verh. Zool. bot. ges. Wien, 1880, **30**, p. 560, pl. 16, f. 10.

Argyroepeira mariana Keyserling, Spinnen Amerikas. Epeiridae, **4**, 1893, p. 345, pl. 18, f. 10.

Locality.— Conservidayo River, August. (M. C. Z. 211, one female). Previously known from Amable Maria and Lima, Peru.

LEUCAUGE IDONEA O. P. Cambridge, var.

Argyroepeira idonea O. P. Cambridge, Biol. Cent. Americana, 1889, **1**, p. 4, pl. 1, f. 7.

Locality.— Panama, June. (M. C. Z. 212, three females).

META EXPLORANS, sp. nov.

Plate **18**, fig. 5.

Carapace yellow with a brown ocellate spot on each side of head, a brown line from each spot extending to the thoracic groove. Sternum black. Legs brown, typically with femora marked with one or two dark annuli at distal end; patellae with one dark annulus; tibiae with three dark annuli and metatarsus with two. Sides of dorsum of abdomen silvery white covered with a network of fine dark lines, the median portion crossed by a rather narrow dark band extending from spinnerets to anterior third or fourth of length, widening cephalad, its lateral edges wavy and the anterior margin arcuate and in front of it often an inverted v-shaped mark; sides and anterior face of abdomen dusky but showing the same areolation as the lateral portions of dorsum; venter of abdomen with a median longitudinal blackish brown band between spinnerets and genital furrow, this bordered on each side by a white, finely areolated stripe.

Posterior row of eyes slightly recurved; median eyes five sixths their diameter apart, one and a third their diameter from the laterals. Lateral eyes on each side contiguous; anterior with diameter exceeding that of posterior in ratio 7:5. Anterior row of eyes recurved; median eyes equal to the posterior medians, two thirds their diameter apart, once and a half their diameter from laterals. Median eyes once and a third their diameter from the lower edge of clypeus. Area of median eyes wider behind than in front in ratio 4:3, scarcely wider than long.

Sternum triangular, the caudal apex narrowly truncate between last coxae. Nearly equal in width and length or scarcely longer (25:24). Lower margin of furrow of chelicera with four teeth of which the end ones are longer than the two intervening.

Length of female 5.5 mm.

Locality.— Conservidayo River, August. (Type, M. C. Z. 206; paratypes, M. C. Z. 319, fifteen specimens). Tincochaca, 7,000 feet, August. (M. C. Z. 207, two immature specimens).

ARGIOPE ARGENTATA (Fabricus).

Aranea argentata Fabr., Ent. syst., 1775, **2**, p. 414.

A very widespread species in tropical and subtropical portions of the western hemisphere, occurring from the southern United States to Patagonia.

Localities.— Panama, June. (M. C. Z. 208, one immature female). Huadquina, 5,000 feet, July. (M. C. Z. 209, one female).

GEA PANAMENSIS, sp. nov.

Plate **19**, fig. 8.

Carapace brown with the sides dusky. Sternum blackish at sides, a median longitudinal stripe yellow. First pair of legs with femora, patellae, and tibiae black, the tibiae each with two narrow pale rings; metatarsi yellow, with three black annuli; tarsi yellow. Second legs similar to the first but femora mostly yellow marked with black especially distad, the third legs being like the second. Fourth legs colored like the first, the femora being more nearly entirely black than that of second or third. Abdomen above with a dark, wavy edged folium-mark embracing a pale sagittate area in the anterior portion which is limited by a dark longitudinal line; venter with a black median longitudinal stripe which widens caudad to spinnerets limited by a yellow line.

Posterior row of eyes very strongly procurved; median eyes twice their diameter apart or nearly so. Lateral eyes contiguous, the posterior on each side much the larger, its diameter being about three times that of the anterior. Anterior row of eyes a little procurved; median eyes carried forward on a conspicuously bulging tubercle, six sevenths their diameter apart, distinctly larger than the posterior medians and much larger than the laterals. Area of median eyes wider behind than in front in about ratio 10: 9. Clypeus viewed in projection directly from in front distinctly narrower than anterior median eye.

Sternum subtriangular, acutely pointed caudad. Winder than long in about ratio 22:19.

Labium with apical portion subtriangular as usual. Endites typical.

Spines of legs few, moderate in length.

Locality.— Panama, June. (Type, M. C. Z. 210, one male).

Acacesia peruviana, sp. nov.

Plate **18**, fig. 6.

Carapace brown. Sternum a paler brown. Legs brown, with the femora of first pair black except at ends, the femur of leg II also dark except proximally, the femora of posterior pairs dark at distal end only. Abdomen above with a dusky or blackish subtriangular mark or folium with wavy edges, this area embracing a wavy edged sagittate mark in its anterior half much as in *foliata;* but the folium narrower and more elongate; venter marked with a deep black median longitudinal stripe from the epigynum to the spinnerets, this narrowing moderately caudad.

Median eyes elevated on a conspicuous rounded tubercle projecting dorsocephalad. Posterior row of eyes strongly recurved; median eyes facing ectad on tubercle, once and a half their diameter apart or nearly so. Lateral eyes not elevated on a tubercle, separated by more than their radius, the anterior one the larger. Anterior row of eyes substraight; median eyes a little smaller than the posterior medians, nearly twice their diameter apart. Area of median eyes slightly wider than long, of equal width anteriorly and posteriorly. Sternum with a short triangular process at caudal end; longer than wide in ratio 6.5 :4.5.

Teeth of lower margin of furrow of chelicera three, these small well separated.

Legs with spines of tibiae few, very slender, more sparse on the metatarsi. Anterior legs much longer than the posterior.

Cephalothorax with head strongly narrowed. Abdomen more nearly strictly rhomboidal than in *foliata.*

Length of female 6.7 mm.

Locality.— San Miguel, 6,000 feet, July. (Type, M. C. Z. 213, one female).

Among other features this species would seem to be clearly separated from *foliata* by the presence of the conspicuous black band along the venter.

EUSTALA FUSCOVITTATA (Keyserling).

Epeira fusco-vittata Keyserling, Sitzungsb. Naturw. ges. Isis, 1863, p. 129, pl. 6, f. 18.
Cyclosa thorelli McCook, Amer. spiders, 1893, **3**, p. 228, pl. 19, f. 11.
Eustala caudata Banks, Proc. Cal. acad. sci., 1898, **1**, p. 255, pl. 15, f. 5.
Eustala fusco-vittata O. P. Cambridge, Biol. Cent. Americana, 1904, **2**, p. 505, pl. 48, f. 3, 4.

A species previously known from Mexico and the West Indies south to Brazil and Paraguay.

Locality.— Panama, June. (M. C. Z. 214, three females).

EUSTALA ANDINA, sp. nov.

Carapace with thoracic part pale yellow, the head light brownish. Sternum light brown, a pale median longitudinal line. Legs testaceous; femora with a broad dark band at distal end, a broader median one, and an indistinct proximal one; patellae dusky, black at distal end; tibiae with three broad dark rings not sharply delimited; metatarsi also with three dark rings; tarsi dark except at proximal end, the mesal portion darkest. Abdomen deep brown in an area covering most of the dorsum, this area with sides concave and converging caudad, the edges wavy, dark, and bordered with yellow; sides dusky or brownish over a yellowish background. Median portion of venter more blackish, enclosing a yellow median dot midway between the genital furrow and the spinnerets and a pair of these nearer the spinnerets.

Abdomen subtriangular with the anterior corners rounded and the caudal end narrowly truncate, this truncate caudal end presenting three low elevations or crenulations.

Posterior row of eyes conspicuously recurved; median eyes once and a fourth their diameter apart and about three times their diameter from the laterals. Lateral eyes equal in size, their radius or scarcely more apart. Anterior row of eyes recurved; median eyes larger than the posterior median eyes (11:8.5), just their diameter apart, farther from the laterals. Area of median eyes wider in front than behind in the ratio 6:5 and wider in front than long in the ratio 10:9.

Lower margin of furrow of chelicera with three teeth of which the most proximal is largest; upper margin with three teeth of which the median is much the stoutest and longest.

Sternum with caudal portion narrowly triangular as in the succeeding species, and the caudal process similarly narrowly truncate.

Spines of legs sparser, short and slender.

Female. Length, 8 mm. Length of cephalothorax, 3.2 mm.; width, 2.7 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	4 mm.	4.2 mm.	3 mm.	1.1 mm.	12.3 mm.
Leg II	3.3	4	2.6	1	10.9
Leg III	2.3	2.2	1.3	.9	6.7
Leg IV	3.7	4	2.6	1.1	11.4

Tibia I, 2.8 mm. Tibia IV, 2.2 mm.

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 215, one female, not quite adult).

EUSTALA MONTICOLA, sp. nov.

Plate 18, fig. 7.

Cephalothorax low, only moderately convex; head low; thoracic groove deep, longitudinal. Abdomen in outline from above subtriangular.

Carapace yellow of very dilute brownish tinge. Sternum and coxae of legs beneath yellow. Legs testaceous, the femora with a wide dusky ring at distal end and one near middle with in some legs a narrower one near base, these rings in the female type not sharply limited, the dusky color being more or less diffused, but in the male more sharply defined; tibiae with three broad dusky rings between which the dark color may also be more weakly diffused; metatarsi of posterior pairs with three annuli of which the proximal one is least distinct, these less clearly defined on the anterior pairs; tarsi with a submedian dark annulus. Abdomen above dark greyish brown, embracing numerous fine dots and spots of white, several pairs of transverse dark lines running from outside a little caudad of mesad but not meeting at middle, the median dorsal line being occupied by a fine dark line which presents short lateral branches; in the male there are caudad on each side two large proximate white spots and farther forward two short white marks. General background of venter of abdomen pale; just back of epigynum a median white spot on each side of which is a black spot of about equal size and farther laterad a longitudinal fine black line which reaches to a dusky area about the spinnerets.

Posterior row of eyes strongly recurved; median eyes a little more than their diameter apart, nearly three times their diameter from the laterals. Lateral eyes on each side their radius apart, scarcely differing in size. Anterior row of eyes recurved; median eyes a little smaller than the posterior medians (diameters as 7:8), twice their diameter apart, and between two and a half and three times their diameter from the laterals. Area of median eyes wider in front than behind in ratio 25:22; wider in front than long (25:22).

Sternum longer than wide in about ratio 5:4. Caudally triangular, the tip narrowly truncate.

Lower margin of furrow of chelicera with three stout conical teeth; upper margin also with three.

Legs well spined, the spines moderate, appressed, blackish.

Female. Length, 7.3 mm. Length of cephalothorax, 3.5 mm.; width, 2.9 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	4.1 mm.	5.2 mm.	3 mm.	1.2 mm.	13.5 mm.
Leg II	4	4.7	3	1	12.7
Leg III	2.3	2.1	1.2	1	6.6
Leg IV	4.6	3.9	2.2	1.1	11.8

Tibia I, 3.8 mm. Tibia IV, 2.3.

Locality.— San Miguel, 6,000 feet, July. (Type, M. C. Z. 216, female; paratype, M. C. Z. 217, immature male).

ARANEA sp. a.

An immature female from Huadquina, 5,000 feet, July. (M. C. Z. 218).

ARANEA sp. b.

An immature female of a second species also from Huadquina. (M. C. Z. 219).

ARANEA sp. c.

An immature female of uncertain species from San Miguel, 6,000 feet, July. (M. C. Z. 220).

ARANEA sp. d.

An immature female from Paltaybamba, 5,000 feet, August. (M. C. Z. 221).

ARANEA ABUNDA (Taczanowski).

Epeira abunda Taczanoski, Horae Soc. ent. Ross., 1878, **14**, 152, pl. 1, f. 7.

Reported by Taczanowski from many localities in Peru.

Localities.— San Miguel, 5,000 feet, September. (M. C. Z. 222, one somewhat variant female). Tincochaca, 7,000 feet, August 9. (M. C. Z. 223, one female also apparently variant).

ARANEA NIGROVENTRIS (Taczanowski).

Epeira nigroventris Taczanowski, Horae Soc. ent. Ross., 1878, **14**, p. 151, pl. 1, f. 6.

Locality.— Cuzco, 11,500 feet, July 6, 12. (M. C. Z. 320, one female; July 12. M. C. Z. 224, numerous specimens).

ARANEA ZELOTYPA (Keyserling).

Epeira zelotypa Keyserling, Verh. Zool. bot. ges. Wien, 1882, **32**, p. 202, pl. 15, f. 7.

Previously known from San Mateo, Peru.

Localities.— Tincochaca, 7,000 feet, August. (M. C. Z. 225, one female). Urubamba, 9,500 feet, July. (M. C. Z. 226, one female).

ARANEA ORINA,[1] sp. nov.

Plate **19**, fig. 3.

Carapace brownish yellow, dusky in an area on each side of caudal portion of head, with also a transverse row of four small black dots across the furrow. Sternum and coxae of legs beneath clear yellow. Endites and labium dusky yellow, whitish across tips. Legs yellowish;

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[1] 'ορεινός, pertaining to mountains.

femora I and II with two broad dark annuli, one just proximad of middle and one at about distal third; femora III with a narrower band at distal end; femora IV black from proximad of middle to distal end; patellae I and II unmarked, but III and IV black at both ends; anterior tibiae with two black bands, one about middle and one at distal end; metatarsi and tarsi dark at distal end, the posterior metatarsi also with a vague dark ring near middle. Bulb of palpus blackish. Abdomen yellow; venter dusky back of the genital furrow except in a narrow transverse band in front of the spinnerets, the dark area divided by a longitudinal median yellow line; dorsum with a folium outlined, a black mark at base and a diamond shaped one near the middle.

Carapace broad, cordate, being very strongly narrowed cephalad. Groove, fine, longitudinal.

Posterior row of eyes strongly recurved; median eyes a little more than their diameter apart, four times or more their diameter from lateral eyes. Lateral eyes on each side separated by about their radius. Area of median eyes conspicuously wider in front than behind (*cir.* 15:11); and wider in front than long in ratio 15:13. Anterior row of eyes nearly straight, the median eyes clearly larger than the posterior medians (ratio of diameters about as 10:7), nearly once and a half their diameter apart and two times their diameter from the laterals.

Sternum not fully two thirds as wide as total length; acutely narrowed caudad.

Lower margin of furrow of chelicera with three teeth; upper margin also with three.

Legs with all joints excepting the tarsi aculeate or spined as usual.

Patella of palpus of male with a very long spine above; tibia on ventral side extended into a thin blade-like process as wide as the length of the joint; process of cymbium on exterior side narrow proximally and expanded distad into a tomahawk form with the blade partially double.

Male. Length 7.7 mm. Length of cephalothorax 3.7 mm.; width 3.1 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	5.6 mm.	6.1 mm.	3.9 mm.	1.5 mm.	17.0 mm.
Leg II	4.2	5	3.2	1.4	13.8
Leg III	3	2.7	1.6	1	8.3
Leg IV	4	4	2.9	1.1	12.0

Tibia I, 4.3 mm. Tibia IV, 2.8 mm.

Locality.— San Miguel, 6,000 feet, July. (Type, M. C. Z. 227, one male).

ARANEA QUECHUANA, sp. nov.

Plate **19**, fig. 1.

Carapace testaceous, unmarked. Sternum dusky brown or blackish. Labium and endites dusky, pale across tips. Legs pale yellow; femora with a wide dusky ring near one third the distance from the distal end or in less deep shade including also the distal portion; posterior patellae darker and the posterior tibiae with darker annulus at distal end. Abdomen whitish yellow; venter with a black area immediately back of the genital furrow but this typically not extending to spinnerets, weakly dusky over each anterolateral corner and caudad from there over upper portion of each side; dorsum with a fine median longitudinal dark line extending from in front of middle caudad and sending off laterad a number of pairs of fine branches, a row of from two to four black dots on each side caudad of the middle, these two rows somewhat converging toward the spinnerets.

Carapace broad and low; groove longitudinal, distinctly impressed, crossed behind by a vague transverse impression.

Posterior row of eyes distinctly recurved as usual; median eyes only five eighths their diameter apart, two and a half times their diameter from the laterals. Lateral eyes subequal, contiguous, raised on a common low black tubercle. Anterior row of eyes slightly recurved; median eyes a little longer than the posterior medians (diameters as 5:4), their diameter apart, once and a third their diameters from the laterals. Area of median eyes wider in front than behind in ratio 14:11; wider than long in about ratio 14:13.

Sternum slenderly extended caudad between the posterior coxae.

Legs abundantly aculeate or spined as usual; two rows of spines on anterior face of tibia II shorter and distinctly stouter than those found elsewhere.

Patella of palpus above at distal end with two long slender spines. Process of cymbium undivided, somewhat clavately expanded distad, moderately curved.

Male. Length 6.2 mm. Length of cephalothorax 3.1 mm.; width 2.8 mm. Tibia I, 3.6 mm.; Tibia IV, 2.1 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	4.25 mm.	5 mm.	4 mm.	1.5 mm.	14.75 mm.
Leg II	4	4.1	3	1.2	12.3
Leg III	2.5	2.25	1.9	1	7.65
Leg IV	3	3.2	2.6	1	9.8

Localities.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 228, male; paratypes, M. C. Z. 229, one immature male). Lucma. (M. C. Z. 329, one male).

ARANEA TIGANA,[1] sp. nov.

Plate **19**, fig. 2.

Carapace pale brown, a broad stripe along each side chocolate or blackish. Sternum blackish. Legs yellow; femora dark at distal ends in a broad band; patellae and tibiae also dusky at distal ends. Abdomen with dorsum white faintly tinged with yellowish, the dorsal light area enclosing four dark dots and in the caudal portion a median black line with side branches; the sides blackish, the lateral dark bands converging caudad and meeting considerably in front of the caudal end.

Posterior row of eyes strongly recurved; medians their radius apart, two and a fourth or more times their diameter from the laterals. Lateral eyes nearly contiguous, the anterior one the larger, elevated on a low common tubercle. Area of median eyes wider than long in about ratio 25:22 and wider in front than behind in about ratio 5:4. Anterior row of eyes distinctly recurved; median eyes larger than the posterior medians (diameters as 5:4), three fifths their diameter apart and not fully their diameter from the laterals.

Sternum of usual shape, being conspicuously narrowed caudad.

Labium of usual form, distinctly triangular.

Legs abundantly spined as usual; spines on the anterior face of tibia II shorter and stouter, in two series.

Palpus with patella above having two long spines at distal end. Tibia flattened and extended ectad as in various other species. Process of cymbium of nearly uniform width throughout, bent nearly at right angles near middle.

Male. Length 6.6 mm. Cephalothorax, length 3 mm.; width, 2.2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	3.8 mm.	4.4 mm.	3.2 mm.	1.6 mm.	13.0 mm.
Leg II	3.1	3.3	2.5	1.1	10.0
Leg III	2.2	2	1.2	1	6.4
Leg IV	3.1	2.7	2	1	8.8

Tibia I, 3.2 mm.

Locality.— Lucma, 7,000 feet, August. (Type, M. C. Z. 230, one male).

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[1] Gosiute *tigana, teguna,* close to.

ARANEA COMPSA,[1] sp. nov.

Plate **19**, fig. 6.

Carapace black excepting the anterior region of the head about the eye-area which is abruptly lighter, pale brown; the pale color extending farther caudad on lower side of head clothed with long grey or white hair. Sternum black with a bright yellow median longitudinal stripe which is interrupted across its anterior portion. Labium and endites black, pale across tips. Legs with femora pale yellow-brown proximally, the distal half blackish; patellae black; tibiae black excepting for a light annulus at the middle; metatarsi and tarsi pale with no distinct black annuli or metatarsus black at extreme distal end. Abdomen brownish grey; venter, anterior face and a broad band reaching back across each anterolateral corner and along side black. A series of yellow dots and marks on each side between black of venter and that of side; dorsum covered with a broad folium-mark a little darker than adjacent parts, the folium embracing a narrow median stripe limited by whitish marks and extending over entire length and marked with light colored paired transverse lines each side of this middle stripe, especially caudad.

Posterior row of eyes decidedly recurved; median eyes three fourths their diameter apart and two and a half or a little more their diameter from the laterals. Lateral eyes on each side contiguous, moderately elevated. Anterior row of eyes clearly recurved; median eyes a little smaller than the posterior medians, more than their diameter apart (once and a half), nearly two and a half times their diameter from the laterals. Area of median eyes nearly equal in length and breadth or slightly wider; wider in front than behind in ratio 11:10.

Thorax of typical form, smooth, without processes; head narrow; groove transverse, not profound.

Labium with distal end triangular.

Sternum about six sevenths as wide as long, constricted to a narrow, distally rounded tongue behind.

Upper margin of furrow of chelicera with four teeth; lower margin with three.

Legs strongly aculeate, the spines long and slender, all joints excepting the tarsi being well armed.

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[1] κομψός, pretty.

Epigynum with scape short; broad at base but narrowed to a slender tip projecting caudoventrad, (Plate **19**, fig. 6).

Female. Length, 6.7 mm. Length of cephalothorax, 2.9 mm.; width, 2.3 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	3.25 mm.	3.2 mm.	3 mm.	1.1 mm.	10.55 mm.
Leg II	3.1	3	2.2	1	9.3
Leg III	2.1	2	1	0.9	6.0
Leg IV	3	2.8	2	1	8.8

Tibia I, 2.1. Tibia IV, 1.9 mm.

Localities.— Ollantaytambo, 9,000 feet, July. (Type, M. C. Z. 231, female; paratype, M. C. Z. 232, female). Urubamba, 9,500 feet, July. (M. C. Z. 233, female).

ARANEA PLESIA,[1] sp. nov.

Plate **19**, fig. 5.

Carapace deep chestnut or blackish, paler along middle part of head. Sternum black. Legs light brownish yellow, the joints annulate with dark about distal ends, the tibiae of anterior pairs also with a subbasal and narrow basal band. Abdomen with median portion of venter black, the black area limited on each side by a narrow yellow longitudinal stripe; lower portion of side black, the rest of sides and the dorsum paler, whitish yellow covered with a close network of fine dark lines; back of middle of length a row of short, solid black, transverse spots or lines each side of the middle, the anterior of these bordered in front with white, on anterior portion of dorsum two curving white lines meeting at an angle on the median line, the figure thus formed having its edges lined with black.

Posterior row of eye conspicuously recurved; median eyes their diameter apart and between two and a half and three times their diameter from the laterals. Lateral eyes subcontiguous and slightly elevated together as usual. Anterior row of eyes straight or slightly recurved; median eyes equal in diameter to posterior medians, nearly one and three sevenths their diameter apart and about the same distance from the laterals or but slightly more. Area of median eyes wider in front than behind (11:10), nearly equal in length and breadth.

[1] πλησίος, close to.

Sternum of usual general shape; caudad abruptly narrowed into a narrow tongue projecting between coxae.

Legs spined as usual; spines of tibiae II not specially modified.

Scape of epigynum long and a little clavate, projecting caudad, (Plate **19**, fig. 5).

Female. Length, 5.1 mm. Length of cephalothorax, 2.5 mm.; width, 2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.25 mm.	3.1 mm.	2.1 mm.	1 mm.	8.45 mm.
Leg II	2	2.3	1.6	.7	6.6
Leg III	1.3	1.8	.9	.5	4.5
Leg IV	2.1	2.1	1.3	.9	6.4

Tibia I, 2 mm. Tibia IV, 1.2 mm.

Locality.— Sorontoy, 7,000 feet, September. (Type, M. C. Z. 234).

ARANEA SANTA, sp. nov.

Plate **19**, fig. 10.

Carapace with pars cephalica testaceous, the pars thoracica abruptly darker, dusky. Sternum testaceous, somewhat dusky, with a clear white T-shaped mark of which the cross-piece is at the anterior end. Labium and endites dusky testaceous. Legs light brown or testaceous, the joints vaguely darker at distal ends but not distinctly annulate. Abdomen above whitish, covered with a close network of fine dark lines and on each side with a series of dark oblique areas; back of middle a median longitudinal black line and a little each side of and parallel with this a broader dark stripe embracing about five small triangular black spots, these two more lateral stripes converging moderately caudad to spinnerets, a small white spot each side of and a little in front of the spinnerets. Anterior face of abdomen brown or dusky brown.

Abdomen suborbicular or but slightly extended at ends, not at all angulate or tuberculate.

Posterior row of eyes conspicuously recurved as usual; median eyes only about six sevenths their diameter apart, twice their diameter from the laterals. Lateral eyes contiguous, subequal. Anterior row of eyes distinctly recurved; median eyes equal to the posterior medians, a little more than their diameter apart, and the same distance or but little farther from the laterals. Area of median eyes equal in length and breadth, wider in front than behind in ratio 10:9.

Sternum of usual general shape; posterior portion triangular, acutely pointed caudad.

Legs abundantly armed with the usual long slender spines.

Length of female 4.7 mm.

Locality.— Santa Ana, 3,000 feet, August. (Type, M. C. Z. 235, one female).

ARANEA SEXTA, sp. nov.

Plate **19**, fig. 7.

Carapace broad behind with the head narrow; thoracic furrow transverse.

Abdomen angulate above on each side near middle, (Plate **19**, fig. 7).

Carapace pale testaceous, the head-region darker and with a fine light median longitudinal line extending caudad from between eyes. Sternum light testaceous. Legs testaceous, not at all annulate with dark. Abdomen in front of level of angles pale testaceous or even of whitish cast cephalad; a white transverse band at level of angles, the abdomen behind this a darker brown; venter pale, somewhat whitish mesally, brown laterally and caudally.

Posterior row of eyes recurved as usual; median eyes circular, their diameter apart or slightly less, nearly three times their diameter from the laterals. Lateral eyes on each side nearly contiguous, the anterior a little the larger. Anterior row of eyes clearly recurved; median eyes equal in diameter to the posterior medians, once and a half their diameter apart and no farther from the laterals. Area of median eyes much wider in front than behind (16:13) and a little wider in front than long (about 8:7).

Sternum with process between posterior coxae long, distally rounded.

Labium and endites of the usual form.

Femora and patellae of legs unspined; the tibiae, metatarsi, and tarsi with fewer long spines and numerous slender short, seriate or subseriate ones chiefly on the anterior surface.

Length of female 4.4 mm.

Locality.— Panama, June. (Type, M. C. Z. 236, female).

Aranea duocypha,[1] sp. nov.

Plate **18**, fig. 8–10.

Abdomen above with two conspicuous conical tubercles, one on each side toward anterolateral corner.

Carapace testaceous, unmarked. Sternum and coxae of legs beneath yellow. Legs dark testaceous, the tibiae obscurely marked with three darker bands, the metatarsi and tarsi darker. Palpi dark at tips. General color of abdomen above yellowish; a black line extending transversely between the tips of the two angular tubercles, this line bent forward at middle and continued cephalad as a median line; caudad of this line a series of other parallel transverse black lines, (Plate **18**, fig. 8). Venter yellow, marked obscurely with a network of somewhat darker lines; epigynum very dilute chestnut.

Posterior row of eyes conspicuously recurved medians nearly once and a third their diameter apart; nearly twice their diameter from the posterior laterals. Lateral eyes on each side separated by about their radius. Anterior row of eye straight or slightly procurved; medians slightly smaller in diameter than the posterior medians, one and two thirds their diameter apart and nearly an equal distance from the laterals; medians just their diameter from the lower edge of the clypeus. Area of median eyes wider in front than behind (10:9) and wider in front than long (also as 10:9).

Caudal end of sternum narrowly triangular, not projecting between coxae; longer than wide in ratio 47:43, (Plate **18**, fig. 9).

Labium and endites of the usual form.

Epigynum with scape very broad, long triangular, projecting much caudad of the genital furrow, (Plate **18**, fig. 10).

Legs sparsely and weakly aculeate, the aculei more numerous distally and on anterior surface.

Length 4.2 mm.

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 237, one female).

Aranea calotypa,[2] sp. nov.

Plate **19**, fig. 4.

Abdomen in outline subelliptic, narrowly obovate when viewed from above, being narrower caudad than cephalad.

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[1] *δύο*, two, *κῦφος*, a hump.

[2] *καλός*, pretty, *τύπος*, mark.

Carapace yellowish or pale testaceous. Eyes black. Sternum yellow. Legs clear yellow, wholly unmarked. Abdomen beneath pale yellowish or whitish yellow, unmarked, but the spinnerets abruptly darker and together appearing like a black spot at the tip of the abdomen; lower part of sides with fine dark dots and streaks; dorsum above dark grey, the color mesally solid and laterally in a fine network enclosing light spots, along the middle line with a series of whitish spots extending over whole length, the most conspicuous marks being three pairs of widely separated black dots and in addition toward caudal end a quadrangle of four more closely approximate black spots.

Posterior row of eyes strongly recurved; medians four fifths their diameter apart and three and three fifths their diameter from the laterals. Lateral eyes contiguous, nearly equal. Anterior row of eyes a little recurved; medians their diameter or a little more apart, not quite fully three times their diameter from the laterals. Area of median eyes a little wider in front than behind (13:121), very slightly wider than long.

Sternum longer than wide in the ratio 11:9, caudad narrowly triangular, the caudal tip not sharply defined.

Labium and endites of typical general form.

Legs of male conspicuously spined as usual, the spines of tibiae, especially of tibia I, longer, stouter and more numerous than those of femora and patellae as usual, the metatarsi and tarsi with but few spines. Legs in the female more weakly aculeate as usual.

Process of cymbium in palpus of male on ectal side of base, arising from a broad base, curved, ending in a swollen tip or button. Patella with a single long spine at distal end above.

Length 5–6 mm.

Localities.— Below Lucma. (Type, M. C. Z. 238; paratypes, M. C. Z. 239, one adult male, one immature male, and three immature females). Tincochaca, 7,000 feet, August. (M. C. Z. 240, one male).

ANAWIXIA,[1] gen. nov.

Thoracic furrow deep, longitudinal, continued upon head, not separated from cervical depression.

Area of median eyes much wider in front than behind. Posterior median eyes decidedly smaller than the anterior, separated by a distance somewhat greater than their diameter. Anterior median

[1] 'ανᾰ́, towards, Wixia.

eyes prominent. Lateral eyes on each side contiguous, on a common prominent tubercle. Posterior row of eyes strongly procurved.

Clypeus much narrower than the eye area; but little exceeding diameter of an anterior eye.

Labium not discrete from sternum; wider than long.

Femur I with three very short ventral spines in a series, five longer, stouter spines along anteroventral surface; tibia I with two ventral spines, five on anterior surface and two on the posterior. Femur II with six ventral spines; tibia II moderately incrassate, with two stout ventral spines and on anterior surface with two series of short, stout spines, six in each series. Femur III unarmed beneath. Femur IV beneath with a series of about eight, mostly very short, spines. Trochanter IV in type with a single stout spine beneath. Coxa I with a hook as in related genera. Posterior tarsi setose beneath; with some accessory claws or stout seriate bristles at the distal end.

Abdomen elongate; much extended caudad beyond the spinnerets which are ventral and submedian in position and with a conspicuous cylindrical slender caudal process; with spinous points above at proximal end and near base of caudal process.

Coxa of pedipalp (male) with a cone-shaped spur distally and femur with the usual chitinous ridge. Patella with a single apical spine. Tarsal sheath with a strongly chitinized non bifid process at base.

Genotype.— *Anawixia atopa,* sp. nov.

Differing from Cyclosa, in the wider separation of the posterior median eyes, and in the spining of the legs.

ANAWIXIA ATOPA,[1] sp. nov.

Plate **20**, fig. 1–3.

Carapace with thoracic part black, the head yellow. Sternum blackish over a yellow background; labium and endites similar except at tips which are clear yellow. Chelicera yellowish, dusky especially proximally. Leg I with femur dusky beneath, deeper black distad, yellowish above; patella black; distal joints yellowish or the tibia somewhat dusky or black distad. Other legs with the femora yellow except at distal end where dusky or black, and two less distinct dark rings, one at middle and one more proximad, the tibiae black at distal end beneath as in Leg I. Abdomen blackish; dorsum with a small pale median spot at base and vague paler markings over middle and caudal regions; venter with a vague pale line on each side and also paler in front of genital furrow.

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[1] ἄτοπος, strange.

Cephalothorax broadly ovate; the head much narrowed, projecting conspicuously forward above and over the clypeus, highest midway between eyes and caudal end.

Abdomen slender, narrowed caudad, at caudal end produced caudo-dorsad into a long, slender, cylindrical process, on each side at base of which is an acute spinous process or point, an acute process or point also occurring toward each anterolateral corner; lower, less distinct cornicles also occurring elsewhere over the dorsum, (Plate **20**, fig. 2).

Posterior row of eyes strongly recurved; median eyes a little more than their diameter apart, and between three and four times their diameter from the laterals. Lateral eyes on each side contiguous, borne upon a common low tubercle at a considerably more ventral level than the medians, the posterior one smaller than the anterior. Quadrangle of median eyes distinctly narrower caudad than cephalad (4:5), wider in front than long (about 25:22), the median eyes raised on a broad, common elevation. Anterior row of eyes straight or slightly recurved; median eyes larger than the posterior medians (diameters about as 9:7), not fully their diameter apart, two and a half times their diameter from the laterals; median eyes projecting conspicuously forward over the receding clypeus. Median eyes about once and a third their diameter from edge of clypeus but seen in projection directly in front appearing only about one half their diameter removed from this edge, (Plate **20**, fig. 1).

Labium not distinctly separated from the sternum; much wider than long; distal portion triangular, its sides straight and meeting at an angle in the median line; proximal portion transversely depressed. Endites well bent, curving over the labium, the inner side conspicuously curved.

Sternum longer than wide in nearly ratio 13:10 or 13:11; widest at level between second and third legs, abruptly indented as usual opposite bases of first coxae slender acute extensions between coxae of legs.

Spinnerets borne on venter not far caudad of middle of length, the abdomen projecting widely over and caudad of them.

Trochanter IV with an acute black spur beneath at the distal end; tibia I with a series of slender spines beneath, (Plate **19**, fig. 3); tibia II proportionately stouter, more strongly spined with short stouter spines on anterior surface, having also two spines toward base on ventral surface; femora I and II with series of ventral spines; femur III with no spines beneath.

Male. Length (not including caudal process), 7.2 mm. Length of cephalothorax, 3.1 mm.; width 2.25 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	4.1 mm.	4.3 mm.	2.3 mm.	1 mm.	11.7 mm.
Leg II	3	3.1	2.1	.9	9.1
Leg III	2.25	2.1	1.1	.6	6.05
Leg IV	2.9	2.9	2	1	8.8

Tibia I, 3 mm.

Locality.— San Miguel, 6,000 feet, July. (Type M. C. Z. 241, one male).

SCOLODERUS HYBUS,[1] sp. nov.

Plate **19**, fig. 9.

Caudal region of head strongly elevated as usual, the tubercle rounded; posterior declivity of cephalothorax steep. Abdomen large and very high, its surface clothed with numerous very short, straight and acutely pointed hairs as is also that of the carapace.

Carapace and legs dusky red-brown, the latter obscurely annulate. Sternum dusky brown, the coxae of legs beneath paler. Abdomen above brownish grey, with vague chevron-lines caudad, the anterior face and sides dusky with on the anterior face a small median white spot, the dark of the sides in part in oblique stripes more vaguely extending upon the dorsum; venter dusky or blackish mesally, paler laterally.

Posterior row of eyes strongly recurved; median eyes one and three fifths their diameter apart, four times their diameter, or somewhat more, from the laterals. Lateral eyes at clypeal corners as usual, contiguous. Anterior row of eyes conspicuously procurved in the typical manner, the median eyes equal in size to the posterior medians, one and two fifths their diameter apart, twice their diameter from lower edge of clypeus, the latter narrower than eye area. Area of median eyes wider than long (9:7); wider behind than in front in the ratio 9:8.

Lower margin of furrow of chelicera with three teeth of which the most proximal is largest; upper margin with four teeth.

Spines of legs few, long.

Epigynum small, of form, (Plate **19**, fig. 10).

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[1] ὑβός, hump-backed.

Length of female 4 mm.

Locality.— Paltaybamba, 5,000 feet, August. (Type, M. C. Z. 242, one female).

MICRATHENA CALA,[1] sp. nov.

Plate **20**, fig. 5.

Carapace brown, the lateral and caudal slopes of the thoracic part dusky. Anterior pairs of legs dark brown, coxae and proximal ends of femora yellowish; posterior pairs yellowish or light testaceous. Sternum solid black. Abdomen above white of a slight yellowish tinge, a dusky mark at each anterior corner and a spot or two in line with this farther caudad; venter and lower portion of sides blackish, the caudal end between apices of lobes also black.

Abdomen bifid behind, each lobe ending in two spines, one above the other; near base of lobe on each side a spinous point and one farther forward toward anterior corner.

Posterior row of eyes recurved as usual; median eyes just their diameter apart, a little more than three times as far from the lateral. Lateral eyes on each side nearly contiguous, the anterior somewhat the larger. Anterior row of eyes recurved; median eyes slightly smaller than the posterior medians, four fifths or a little less their diameter apart, their diameter from lower margin of clypeus, more than three times their diameter from the laterals. Area of median eyes wider behind than in front in about ratio 15:13, nearly equal in length and breadth.

Sternum shield shaped; longer than wide nearly in ratio 7:6.

Lower margin of furrow of chelicera with three teeth of which the most proximal is largest.

Spines on anterior face of femora longest.

Length of female 5.3 mm.

Locality.— San Miguel, 6,000 feet, July. (Type, M. C. Z. 243, female).

GASTERACANTHA RAIMONDI Taczanowski, var.

Horae Soc. ent. Ross., 1879, **15**, p. 106, pl. 1, f. 25, 26.

Previously known from various other localities in Peru and from Brazil.

Locality.— Huadquina, 5,000 feet, July. (M. C. Z. 246, one female).

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[1] καλός, beautiful.

MIMETIDAE.

Gelanor innominatum,[1] sp. nov.

Plate **20**, fig. 6.

Carapace from greenish yellow to light brown, either not at all distinctly marked or, in lighter individuals, with two dark marks on caudal region of head and one on each side of the pars thoracica. Sternum yellow to pale brown, with the labium a little darker. Chelicera from yellow to pale brown of a slightly reddish cast. Legs yellow; first pair typically with four black or dark brown spots on caudal side of femur with a fine unbroken black line along the dorsal surface; tibia dark about the distal end. Second legs marked like the first but the spots narrower and together appearing more like a broken line. Femora of legs III and IV with a fine median longitudinal dorsal dark line at distal end. Tibia IV and metatarsus IV with a fine median dorsal longitudinal dark line over entire length. Abdomen above dark brown over proximal half, testaceous over caudal; typically with five narrow transverse light stripes with each margin limited by a fine black line, two pale spots in front of the first of these and a black mark caudad of the last; venter yellow or somewhat testaceous, dusky in front of the spinnerets and just in front of the genital furrow.

Posterior row of eyes recurved; median eyes a little more than their radius apart, slightly less than three times their diameter from the laterals which are of equal diameter; laterals slightly larger than the anterior laterals with which they are contiguous. Anterior median eyes about one and two thirds the diameter of the laterals; four fifths their diameter apart, and about once and a fifth their diameter from the lateral one on each side.

Labium with sides strongly convex; much narrowing distad; distal margin subtruncate or slightly convex.

Sternum less than three fifths as wide as total length inclusive of the process between the posterior coxae.

The first two pairs of legs are much longer and stouter than the two posterior pairs; but the second are decidedly smaller and less stout than the first. Anterior tibiae moderately bowed, the metatarsi more conspicuously so.

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[1] *innominatus*, nameless.

Tibia I with seven of the longer spines and four or five smaller distally curved ones between each two longer ones, these smaller ones increasing in length distad as usual; four large spines on metatarsus I, the number of small spines between each two large ones increasing distad, those distad of the last large spine much more numerous. Large spines of tibia II mostly five, of metatarsus II three.

Length of female, 5.7 mm. Length of cephalothorax, 3 mm.; width, 2.1 mm.

Locality.— San Miguel, 6,000 feet, July. (Type, M. C. Z. 244, female; paratypes, M. C. Z. 245, two females).

THOMISIDAE.

MISUMENOPS CONSPERSA (Keyserling).

Misumena conspersa Keyserling, Spinnen Amerikas. Laterigradae, 1880, **1**, p. 107, pl. 2, f. 59.

Localities.— Huadquina, 5,000 feet, July. (M. C. Z. 321, one female). Santa Ana, 3,000 feet, August. (M. C. Z., 249, one male, one female).

Previously known from Guadalupe, Vacarmayu, and San Malu, Peru.

MISUMENOPS PALLENS (Keyserling).

Misumena pallens Keyserling, Spinnen Amerikas. Laterigradae, 1880, **1**, p. 96, pl. 2, f. 52.

Localities.— Huadquina, Peru, 5,000 feet, July. (M. C. Z. 247, one female). Panama, June. (M. C. Z. 248, one female).

Previously known from Guatemala, Colombia, Peru, and Chile.

THANATUS TAQUARAE Keyserling.

Spinnen Amerikas. Bras. Spinnen, 1891, **3**, p. 252, pl. 10, f. 191.

Localities.— Huadquina, 5,000 feet, July. (M. C. Z. 250, one young female). Ollantaytambo, 9,000 feet, July. (M. C. Z. 251, female).

Previously known from Brazil (Taquara) as well as from Peru (Yura).

TIBELLUS PUNCTULATUS (Taczanowski).

Thanatus punctulatus Taczanowski, Horae Soc. ent. Ross., 1872, **9**, p. 10.

Locality.— Santa Ana, 3,000 feet, August. (M. C. Z. 253, female). Previously known from Guiana.

CLUBIONIDAE.

EUSPARASSUS SHEFTELI, sp. nov.

Plate **20**, fig. 7–8; Plate **21**, fig. 1.

Carapace dark chestnut, blackish over anterior cephalic region and along the lateral margins. Chelicerae black. Femora chestnut, distally more blackish; distal joints blackish over a chestnut background. Sternum dark chestnut or mahogany, the labium and endites similar excepting for the paler distal ends. Hair of these parts mostly of a golden lustre, that of the carapace in part grey; hair of the legs long. Abdomen light brown; hair long, subdense, yellowish.

Posterior row of eyes much longer than the anterior (39:34), moderately procurved; eyes subequal; median eyes near once and a half their diameter apart, a little farther from the laterals. Posterior laterals two thirds their diameter from the anterior laterals, larger in the ratio 10:9. Anterior row of eyes straight, the median eyes a little larger than the laterals (ratio 11:10), about their radius apart and the same distance from the laterals. Median eye-area wider behind than in front in ratio 8:7; its length equal to anterior width.

Upper margin of chelicera with two teeth; the lower with three of which the most proximal is the smallest.

Labium semicircular; more than twice as wide as long (42:19); notches at base slight, (Plate **20**, fig. 8).

Claw of palpus distinct; pectinate. Tarsus densely scopulate over nearly entire surface both above and below. Femur and tibia each with a long subbasal spine toward the distal end.

Sternum subtriangular; anterior margin straight; narrowly acutely extended between posterior coxae, (Plate **20**, fig. 7).

Femora of first three pairs of legs with three spines on anterior, three on posterior, and two on dorsal surface; femur IV with spining the same excepting that the spines of the posterior surface are lacking.

Each patella with a single spine on its posterior side. Tibiae I and II with 3–3 spines beneath, two on the anterior side, two on the posterior, and one above; tibiae III and IV the same except for absence of the dorsal spine. All metatarsi with two spines beneath, two in front, and two behind. Claws all strongly pectinate, the teeth increasing in length distad. All tarsi and metatarsi scopulate beneath.

Female. Length, 17.5 mm. Length of cephalothorax, 7.5 mm.; width, 7 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	8 mm.	10 mm.	6.5 mm.	2.2 mm.	26.7 mm.
Leg II	8.8	10.9	7.2	2.3	29.2
Leg III	7.2	8.0	5.0	2.0	22.2
Leg IV	7.2	7.9	5.5	2.2	22.8

Tibia I, 6.8 mm. Tibia IV, 5.2 mm.

Locality.— Santa Ana, 3,000 feet, August 3. (Type, M. C. Z. 252, female).

This species is named in honor of Mr. Herbert Sheftel of New York.

HORIOCTENUS,[1] gen. nov.

Cephalothorax ovate, convex; thoracic stria long and distinct, radial lines not evident.

Posterior row of eyes strongly recurved or appearing as two rows; eyes subequal, the medians nearer to each other than to the laterals. Anterior row of eyes recurved; eyes subequal and nearly equidistant, the median eyes in type a little the smaller. Area of median eyes longer than wide, a little narrower in front.

Clypeus narrower than length of area of median eyes, receding from the anterior eyes ventrocaudad.

Labium wider than long.

Lower margin of furrow of chelicera with one tooth, the upper with three.

Legs robust. Tibiae of first and second legs armed beneath with three pairs of spines; the metatarsi with a single pair of long spines at the proximal end; metatarsi and tarsi densely scopulate. Tarsi of posterior legs more sparsely scopulate.

Inferior spinnerets (in type species) not contiguous at base. Superior spinnerets with second article short.

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[1] ὅριος, pertaining to the borders or limits, etc. and Ctenus.

Genotype.—*Horioctenus lycosoides*, sp. nov.

Readily distinguished from Caloctenus and Odo, both occurring in the Andean region, in having but a single tooth on the lower margin of the chelicera, as well as in eye relations and characters of legs.

Horioctenus lycosoides,[1] sp. nov.

Plate **21**, fig. 2–4.

Integument of carapace dark brown with a median longitudinal yellow or light testaceous stripe from the eye-area to the caudal margin; this median stripe anteriorly as wide as the eye-area from where it first widens and then narrows again and remains of nearly uniform width to the posterior declivity down which it narrows to the caudal margin; also a narrow paler supramarginal stripe along each side; carapace clothed densely with chiefly light grey or white hairs, dark hairs much sparser. Sternum dusky chestnut, the labium similar excepting at the tip, the endites paler, all these parts clothed with grey hair like that of the carapace. Legs brown, irregularly but abundantly, especially the femora, streaked and spotted with blackish; hair chiefly grey but with stiffer dark bristles more abundantly intermixed than on the carapace. Abdomen with the integument brown, a sagittate outline in some vaguely indicated at the base above, this followed by a series of equally vague cross-marks; densely clothed with grey and coarser brown hairs intermixed.

Posterior row of eyes longer than the anterior; very strongly recurved; median eyes but little larger, separated from the laterals by about their diameter, only half as far from each other. Anterior row of eyes decidedly recurved both in dorsal and in anterior view, the median eyes being borne well forwards; eyes equidistant, less than their radius apart; median eyes smaller than the laterals (ratio of diameters about as 4:5).

Labium clearly wider than long (23:19); sides convex, decidedly converging to the rounded or mesally truncate anterior margin; basal notches short, (Plate **21**, fig. 2).

Endites not impressed.

Palpus strongly spined; claw with five teeth.

Teeth of upper margin of chelicera rather slender, decreasing from the one nearest claw proximad; single tooth of lower margin also small, (Plate **21**, fig. 4).

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[1] Lycosa, εἶδος, form.

Sternum moderately convex; anterior margin widely weakly convex; caudad acutely narrowly pointed, not separating the fourth coxae; widest near middle; longer than wide in about ratio 5:4.

Epigynum proportionately large, (Plate **21**, fig. 3).

Female. Length, 9 mm. Length of cephalothorax, 4 mm.; width, 3.1 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	3.25 mm.	4.2 mm.	2.2 mm.	1.6 mm.	11.25 mm.
Leg II	3.0	4.0	2.0	1.5	10.5
Leg III	3.0	3.5	2.0	1.4	9.9
Leg IV	3.5	4.8	3.8	2.0	14.1

Tibia I, 2.9 mm. Tibia IV, 3 mm.

Localities.— Ollantaytambo, 9,000 feet, July. (Type, M. C. Z. 254, one female). Urubamba, 9,500 feet, July. (M. C. Z. 255, two females).

GAYENNA MONTICOLA, sp. nov.

Plate **22**, fig. 6.

Carapace yellow; a dusky median longitudinal line which is geminate back of the eyes as in Pirata sp.; also a dusky supramarginal stripe on each side extending forward to the head. Sternum yellow, dusky at margins. Endites yellow. Labium dusky yellow. Legs yellow, dark about the bases of spines and in other small spots, giving the appearance of broken annulations on the proximal joints. Integument of abdomen greyish brown; above with a narrowly lanceolate dark median stripe at base, followed by a series of paired dark marks which extend to a little in front of the spinnerets, the two lines converging caudad; a dusky stripe along each dorsolateral line proximally below which are scattered inconspicuous dark spots; venter clear excepting for an interrupted median longitudinal dark line.

Posterior row of eyes moderately procurved; median eyes once and a half their diameter apart, their diameter from the laterals which are a little the larger (diameters about as 7:6). Posterior laterals subequal to anterior laterals from which they are separated by four sevenths their diameter. Anterior row of eyes straight, decidedly shorter than the posterior; laterals larger than the medians (diameters as 7:6); medians near their radius apart, contiguous with the laterals or nearly so. Clypeus about four sevenths as wide as diameter of an anterior lateral eye. Area of median eyes equal in length and breadth or slightly longer than wide (22:21); narrower in front than behind in about the ratio 15:21.

Sternum longer than wide in nearly ratio 35:24. Truncate anteriorly; widest near middle; angle at caudal end moderate, scarcely acute. Labium narrowed from basal notches distad, the sides being weakly convex; distal margin truncate.

Upper margin of furrow of chelicera armed with the usual three teeth of which the median is much the largest; lower margin with two subequal teeth.

Tibia I and II with three pairs of spines beneath, of which the distal are much the smallest, the two proximal pairs being long and appressed; metatarsi I and II with a single basal pair of long spines beneath. Posterior tibiae and metatarsi strongly spined beneath, laterally and above. Femur I with five spines above, (three in a transverse row distally, one submedian and one subbasal). Metatarsi and tarsi I and II scopulate to base; tarsi III and IV more sparsely scopulate, the corresponding metatarsi not at all.

Female. Length, 8 mm. Length of cephalothorax, 2.7 mm.; width, 2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.0 mm.	2.3 mm.	1.3 mm.	1 mm.	6.6 mm.
Leg II	2.1	2.3	1.3	1	6.7
Leg III	2	2.1	1.2	1	6.3
Leg IV	2.3	2.9	1.5	1.1	7.8

Localities.— Cuzco, 11,500 feet, July. (Type M. C. Z. 256, female). Ollantaytambo, 9,000 feet, July. (M. C. Z. 257).

ANYPHAENA ANDINA, sp. nov.

Plate **22**, fig. 4.

Carapace yellow, of a darker shade along the sides; blackish over eye-area, in a short narrow streak caudad from each posterior median eye and in a short median line, bifurcate behind, just in front of the fovea thoracica. Sternum and endites clear yellow, the labium of a little darker tinge. Legs yellow, indistinctly marked with broken annuli of which one at distal end of femora and one on patella (especially of the posterior legs) are most pronounced. Abdomen ventrally and laterally yellow; the dorsum covered with a close network of mostly confluent dusky brown spots among which a median longitudinal pale line limited by uneven dark lines may be traced.

Posterior row of eyes only slightly procurved, nearly straight; medians a little more than their diameter (*cir.* once and a seventh) apart, a little less than their diameter (six sevenths) from the laterals. Anterior row of eyes much shorter than the posterior (41:31); straight or scarcely recurved; medians smaller than the laterals (ratio of diameters 5:7), slightly more than their radius apart (three fifths diameter) and almost contiguous with the laterals. Clypeus narrower than diameter of eyes. Area of median eyes equal in length and breadth; three fourths as wide in front as behind.

Sternum longer than wide nearly in ratio 15:11.

Labium much longer than wide; crenately notched or incised mesally at distal end.

Lower margin of furrow of chelicera with four or five teeth of which the two more distal are longer than the others.

Tibia I with three pairs of ventral spines of which the distal are short and those of the other two pairs long; also bearing on the anterior side three spines and one dorsally. Metatarsus I below with a basal pair of long appressed spines; on anterior side with two spines of which the basal is smaller than the median, and three pairs of dorsal or subdorsal spines. Femur I with three spines along mid-dorsal line. Anterior tarsi scopulate; metatarsi sparsely scopulate distad; posterior tarsi scarcely truly scopulate or with but few scopular hairs.

Distal article of superior spinnerets abruptly narrower than the proximal, cylindroconical, small.

Rima ventralis nearly equidistant between bases of spinnerets and the genital furrow.

Female. Length, 6.8 mm. Length of cephalothorax, 2.7 mm.; width, 2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.1 mm.	3.1 mm.	1.8 mm.	1.2 mm.	8.2 mm.
Leg II	2.1	2.6	1.7	1.1	7.5
Leg III	2	2.1	1.2	1	6.3
Leg IV	2.2	3.0	2.2	1	8.4

Tibia I, 2.2 mm.

Locality.— Tincochaca, 7,000 feet, August. (Type, M. C. Z. 258, one female).

ANYPHAENA APORA,[1] sp. nov.

Plate **22**, fig. 2–3.

Carapace a brownish or dusky yellow with no distinct markings. Chelicerae dilute chestnut. Sternum nearly same as carapace. Endites pale chestnut, the labium darker excepting at pale tip. Legs dusky yellow above, darker distad, clearer yellow beneath; darker annuli vaguely indicated on tibiae. Abdomen dusky grey over a yellowish background, the venter somewhat paler than the dorsum, with no distinct markings.

Posterior row of eyes nearly straight or only very slightly procurved; medians their diameter apart, slightly closer to the laterals. Anterior row of eyes shorter than the posterior in the ratio 41:55; straight or very slightly recurved; medians much smaller than the laterals (diameters as 7:10), about four sevenths their diameter apart and one seventh their diameter from the laterals; median eyes nearly their diameter from the lower edge of the clypeus, the laterals but little more than their radius. Posterior lateral eyes larger than the anterior medians from which they are separated by only about one fourth their diameter. Area of median eyes equal in length and breadth; wider behind than in front in ratio 28:17.

Sternum longer than wide in ratio 45:37.

Labium much longer than wide (40:25). Basal notches long. Sides only weakly convex and but little converging distad; distal margin conspicuously concave from side to side, (Plate **22**, fig. 2).

Lower margin of furrow of chelicera with four moderately large, well-spaced teeth.

Tibia I armed with three pairs (or 2, 2, 1) of ventral spines of which the most distal are some distance proximad of the distal end of the article and are of smaller size; two spines on anterior side and two on the posterior. Metatarsus I with one pair of long appressed, subbasal spines on ventral surface and with two pairs of subdorsal (each on dorsolateral line) in position. Femur I above with three spines along middorsal line, three in line cephalad of these and two in a line caudad. Anterior tarsi and metatarsi scopulate to base and tibia I also with some scopular hairs at distal end.

Female. Length, 8 mm. Length of cephalothorax, 3.6 mm.; width, 2.8 mm.

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[1] *ἄπορος*, difficult.

	fem.	tib.+pat.	met.	tar.	total
Leg I	4 mm.	5.2 mm.	3 mm.	2 mm.	14.2 mm.
Leg II	3.8	5	3	1.8	13.6
Leg III	3	3.2	2.5	1.2	9.9
Leg IV	3.2	4.2	3.3	1.3	12.0

Tibia I, 4 mm. Tibia IV, 2.9 mm.

Locality.— Conservidayo River, August. (Type, M. C. Z. 259).

ANYPHAENA POICILA,[1] sp. nov.

Plate **22**, fig. 5.

Carapace dusky brown with a clear yellow stripe along each side above a black marginal line that completely encircles the carapace; a lighter median longitudinal area on head back of eyes this narrowing caudad and enclosing a black line over and back of each posterior median eye; a black line from clypeus over each anterior median eye and extending back across each posterior lateral eye. Sternum black; a narrow interrupted yellow marginal line, a very narrow median yellow line from anterior margin to middle and on each side a series of three small yellow dots converging caudad where there is a median spot. Labium and endites dusky over a yellow background, pale across tips. Legs yellow; a heavy black annulus on femora just distad of middle, one at proximal end of tibia and one near each end of metatarsus. Tarsus of palpus with a distinct black ring at proximal end, the tibia also with an interrupted narrower line across proximal end and small spots across distal; patella and femur also with small black dots. Abdomen in general yellow; above with a narrowly deltoid dark brown mark at middle, this continuing forward from its apex in a narrower median stripe which expands at the base into a mark of lanceolate form with apex cephalad. Anterior portion of sides brown, each band followed caudad toward spinnerets by a number of brown spots, some of which unite in several lines across dorsum in front of spinnerets. Venter with a median longitudinal brown stripe which is broadest caudad, is broken across middle, and extends to the genital furrow; on each side of this with scattered small dots, some of which are arranged in lines, (Plate **22**, fig. 5).

Posterior row of eyes decidedly procurved, a line tangent to anterior edges of medians intersecting the laterals back of their middles; medians their diameter apart, five sixths as far from the laterals which are of the same size or nearly so. Posterior lateral eyes equal to the anterior laterals from which they are separated by two thirds their diameter. Anterior row of eyes shorter than the posterior in ratio 25:33; slightly recurved; medians smaller than laterals, their diameters being to each other nearly as 2:3, their radius apart, nearly half as far from the laterals. Clypeus a little narrower than diameter of a median eye. Area of median eyes longer than wide in ratio 7:6; wider behind than in front in ratio 3:2.

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[1] ποικίλος, spotted.

Sternum longer than wide in the ratio 62:47.

Labium some more than two thirds as wide as long; apex squarely truncate, not incised or indented.

Lower margin of furrow of chelicera with four small teeth decreasing in size proximad as usual.

Tibia I with three pairs of ventral spines of which the two first pairs are long, those of the basal pair reaching the bases of the median ones, the distal pair small; two spines on the anterior and two on the posterior surface. Metatarsus I with the usual pair of long ventral spines at base; two spines on anterior and two on posterior side. Scopulae very sparse. Femur I with three spines in middorsal line, and also one caudad of this line and two cephalad.

Female. Length, 5.1 mm. Length of cephalothorax, 2 mm.; width, 1.8 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.1 mm.	3 mm.	1 mm.	1 mm.	7.1 mm.
Leg II	2	2.8	1.7	1	7.5
Leg III	1.8	1.9	1.1	.9	5.7
Leg IV	2.1	2.2	1.7	1.1	7.1

Tibia I, 1.3 mm. Tibia IV, 21 mm.

Locality.— Huadquina; 5,000 feet, July. (Type, M. C. Z. 260, one female not quite mature).

ANYPHAENA sp.

Locality.— Tincochaea, 7,000 feet, August. (M. C. Z. 330, one immature specimen).

Castaneira quechua, sp. nov.

Plate **22**, fig. 1.

Carapace, sternum, and chelicerae black; labium and endites also nearly black excepting for pale tips. Coxae ventrally yellowish, the femora black, the succeeding joints more or less dark testaceous, except the tibia and metatarsus of fourth legs which are nearly black. Abdomen black, a vague light line across middle above and laterally but not crossing middle part of the venter. Carapace with numerous white plumose hairs. Legs with similar hairs but also with numerous black hairs intermixed. Abdomen with white plumose hairs and many simple black hairs.

Posterior row of eyes procurbed in such degree that a line tangent to the anterior edges of the medians cuts the laterals near the beginning of the caudal third; medians nearly once and a third their diameter apart, less than their diameter from the laterals which are of the same size or nearly so. Area of median eyes equal in length and breadth or very nearly so, scarcely narrower anteriorly than posteriorly. Anterior row of eyes procurved; median eyes their radius apart, half as far from the laterals; medians with diameter exceeding that of laterals in ratio 9:7; the long diameter of the laterals exceeding the lesser diameter nearly in ratio 7:5. Clypeus a little wider than the diameter of a median eye (about as 11:9).

Sternum three fourths as wide as long; borders depressed as usual; anterior margin straight, sides converging to meet at an angle caudad but the angle not acute.

Labium and chelicerae typical.

Tibia of leg I armed beneath with three pairs of spines, metatarsus with two pairs. Tibia II with but two pairs of spines beneath, the metatarsus also with two pairs. Tarsi and metatarsi I and II scopulate to base; metatarsi III and IV scopulate only distally.

Female. Length, 8 mm. Length of cephalothorax, 3.25; width, 2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.6 mm.	3 mm.	2 mm.	1.2 mm.	8.8 mm.
Leg II	2.2	2.8	1.9	1.1	8.0
Leg III	2.2	2.4	2.0	1.1	7.7
Leg IV	2.6	3.5	3.1	1.3	10.3

Tibia I, 2.1 mm. Tibia IV, 2 mm.

Locality.— Conservidayo River, August. (Type M. C. Z. 261, one female).

Quechuella, gen. nov.

Cephalothorax ovate with the frons moderately broad; stria thoracica fine but distinct, of moderate length.

Posterior eyes subequal (in type the lateral a little the larger), nearly equidistant, in a weakly procurved row. Lateral eyes on each side separated by less than their diameter. Anterior eyes in a recurved row; median eyes much smaller than the laterals, separated from each other but nearly contiguous with the laterals.

Clypeus much narrower than the anterior median eyes.

Lower margin of furrow of chelicera armed with four small teeth.

Labium extending beyond middle of endites; longer than wide though not greatly so; distally truncate.

Anterior tibiae (compressed in type) without spines.

Furrow of posterior spiracle well in front of middle.

Distal article of superior spinnerets short, conical.

Genotype.— *Quechuella lampra,* sp. nov.

Distinguished from Anyphaena and related genera similarly having the furrow of the posterior spiracle in front of middle in wholly lacking of spines on the anterior tibiae and by its very narrow clypeus.

Quechuella lampra,[1] sp. nov.

Plate **21**, fig. 5–8.

Carapace pale yellowish brown, dusky over sides and eye-region. Sternum, endites, and labium yellow. Coxae of legs beneath and proximal portions of femora yellow; legs more distad, especially the tibiae and metatarsi, dusky to nearly black, the tarsi again paler. Abdomen ventrally and over lower portion of sides a dilute yellowish white; dorsum a very dilute brownish, marked at the base in the median line with a darker narrow stripe which is followed caudad by a series of paired dark dots extending to the spinnerets and on each side of dorsum and upper part of sides also darker, (Plate **21**, fig. 7).

Posterior row of eyes very slightly procurved; medians slightly smaller than the laterals (ad. 5:6), a little less than their diameter

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[1] λαμπρός, distinct.

(four fifths) apart, their diameter from the laterals. Lateral eyes on each side equal, their radius apart. Anterior row of eyes recurved; medians smaller than the laterals (diameters as 4.5:6), one third their diameter apart, closer to the laterals. Clypeus very narrow, about one third the diameter of an anterior median eye wide. Area of median eyes nearly equal in length and breadth; wider behind than in front in ratio 2:3, (Plate **21**, fig. 8).

Sternum widest back of middle, much narrowed cephalad; more abruptly narrowed caudad, the caudal angle not very acute; wider than long in ratio 15:13, (Plate **21**, fig. 6).

Anterior tibiae flattened dorsoventrally, apparently wholly unspined; anterior metatarsi with a pair of very short spines beneath. Posterior tibiae and metatarsi with spines as usual.

Furrow of posterior spiracle situated at about one third the distance from the genital furrow to the spinnerets.

Length of female, 4.1 mm. Length of cephalothorax, 1.7 mm.; width, 1.2 mm.

Locality.— San Miguel, 6,000 feet, July. (Type, M. C. Z. 262, one female not fully mature).

TRACHELOPACHYS BICOLOR, sp. nov.

Plate **21**, fig. 9–10.

Cephalothorax with chelicerae, labium and endites, and the entire abdomen solid black or the abdomen above with very vague chevron-lines caudad. Spinnerets yellowish. Legs clear yellow, the scopulae giving them a dusky appearance at distal ends.

Posterior row of eyes recurved in such degree that a line tangent to caudal edges of medians cuts through the anterior fourth of the laterals; median eyes a little smaller than the laterals, twice their diameter apart, farther from the laterals. Anterior row of eyes a little procurved; laterals much larger than the medians (diameters about as 3:2); median eyes their diameter apart, about half as far from the laterals. Clypeus twice as wide as diameter of median eye. Area of median eyes equal in length to width behind; wider behind than in front in ratio 7:6.

Sternum longer than wide in a little less than the ratio 4:3; strongly convex, the borders being much above (dorsad of) level of median portion.

Labium strongly thickened across base, the thickened portion separated by a distinct transverse furrow from the distal portion; sides moderately converging distad, substraight proximad, convex toward tip; apically truncate; wider than long in ratio 6:5, (Plate **21**, fig. 9).

Upper margin of furrow of chelicera with the usual three stout teeth of which the median is largest; lower margin with two stout and subequal teeth.

Palpus of female unspined; claw smooth.

Tarsi and metatarsi of legs I and II densely scopulate and with some scopular hairs on distal end of tibia; tarsi and distal portion of metatarsi also scopulate in legs III and IV. All legs without spines.

Female. Length 8 mm. Length of cephalothorax 4 mm.; width, 3.2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	3 mm.	3.7 mm.	2 mm.	1.3 mm.	10.0 mm.
Leg II	2.8	3.3	1.9	1.2	9.2
Leg III	2.2	2.7	1.8	1	7.7
Leg IV	3.2	3.8	2.7	1.3	11.0

Tibia I, 2.2 mm. Tibia IV, 2.4 mm.

Localities.— Urubamba, 9,500 feet, July. (Type, M. C. Z. 263, female; paratype, no. 264, one female). Ollantaytambo, 9,000 feet, July. (M. C. Z. 265, one female).

PISAURIDAE.

TRECHALEA sp.

Three immature specimens of an uncertain species were secured at Huadquina, 5,000 feet, July. (M. C. Z. 266).

TRECHALEA MONTICOLA, sp. nov.

Plate **23**, fig. 1.

Carapace brown, darker, more black, along the lateral borders; on each side a pale supramarginal stripe uniting with the one of opposite side across the clypeus, these stripes more or less zig-zag; a median longitudinal pale band narrow from caudal margin to the pars cephalica upon which it expands to nearly the width of the eye-area and then extends as a narrow tongue between the eyes, this broad portion embracing a longitudinal dark line back of each posterior median eye and a pair of broader stripes between this and the one of opposite side. Sternum yellow, a pair of large dark spots on the middle portion and a dusky line within each lateral border. Labium dusky, pale across tip. Endites yellow. Chelicerae yellowish, somewhat darker proximally. Legs yellowish brown or testaceous, the femora and coxae beneath clear yellow or whitish yellow, the femora darker distad; over the anterodorsal surface the femora are marked with a series of four large dark spots. Abdomen with venter dusky yellowish; sides and dorsum greyish black, a lanceolate outline at base above in black and a series of about four white spots on each side.

Face and clypeus much sloping as usual.

Anterior row of eyes slightly recurved; shorter than the row formed by the two posterior median eyes (28:31); median eyes much larger than the laterals, the diameter being nearly twice as great (15:8); median eyes not fully their radius apart (five sevenths) and scarcely more than half as far from the laterals; medians about once and a third their diameter from lower margin of clypeus. Posterior median eyes with diameter one and a third times that of the anterior medians, their diameter apart and less than their radius from the anterior medians. Area of posterior eyes wider behind than in front in ratio 115:62, nearly 2.4 times wider than long.

Lower margin of furrow of chelicera with three stout conical teeth.

Labium longer than wide in ratio 7:6; basal notch one fourth the total length; distal margin widely but very weakly convex, subtruncate; sides convex and moderately converging distad.

Total length of sternum including caudal process exceeding the width nearly as 10:9.

Tarsi of legs all slender and distinctly curved or bent, their diameter least near middle of length. Paired claws of leg I with five slender and moderately divergent teeth on the proximal half; unpaired claw small, abruptly bent, with one slender spine or tooth, (Plate **23**, fig. 1).

Female. Length, 9 mm. Length of cephalothorax, 4.3 mm.; width, 4.7 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	5.6 mm.	7.1 mm.	5.25 mm.	3 mm.	20.95 mm.
Leg II	7	8.7	6.6	3	25.3
Leg III	5.8	6.5	5.1	3	20.4
Leg IV	6.3	8	7.25	4	25.55

Tibia I, 5 mm. Tibia IV, 6 mm.

Locality.— Santa Ana, 3,000 feet, August. (Type, M. C. Z. 267, one female, not quite adult).

TUNABO,[1] gen. nov.

Cephalothorax longer than broad, moderately convex, the posterior declivity abrupt; thoracic stria long.

The anterior row of eyes weakly procurved; median eyes farther from each other than from the laterals, a little larger than the laterals. Posterior eyes in two distinct rows as in Lycosa, much larger than those of the anterior row. Area of median eyes decidedly wider than long and much wider behind than in front. Clypeus much narrower than area of median eyes, only a little exceeding the diameter of an anterior median eye; subvertical.

Labium wider than long.

Lower margin of furrow of chelicera with four teeth.

All tarsi, and the anterior metatarsi at least in part, scopulate. Anterior tibiae armed beneath with five pairs of spines, the distal pair small and the others very long; the metâtarsi armed beneath with three pairs of spines.

Genotype.— *Tunabo peruvianus* sp. nov.

Easily distinguished from Trechalea, the preceding genus, in having the anterior eyes in a procurved row, and from Hygropoda, also occurring in the Andean region and a closely related genus, in the relatively much larger posterior eyes, in the much narrower clypeus, and in having leg IV longer than leg I.

TUNABO PERUVIANUS, sp. nov.

Plate **22**, fig. 7–9.

A sharply defined median longitudinal stripe over entire length of carapace and abdomen, this limited on each side on the carapace by a black stripe below which is a testaceous stripe of about the same width, this enclosing some dark dots, the margins darker; on the abdomen the median stripe is limited on each side by a dark brown stripe, the sides and venter of abdomen pale, brownish grey with numerous small dark dots. Sternum yellow or dilute light brown minutely spotted with black and with a median longitudinal black line on caudal half. Labium and endites yellow or testaceous. Legs brown, the coxae and the femora beneath paler; femora marked above with longitudinal blackish lines and the legs elsewhere minutely spotted and streaked with dark. Chelicera each with a black longitudinal stripe down its front face.

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[1] Gosiute *tuna*, straight, and *nabo*, a mark.

Anterior row of eyes shorter than the second (about as 11:12); slightly procurved; diameter of medians greater than that of laterals in ratio 4:3; medians three fourths their diameter (or a little farther) apart, their radius or slightly more from the laterals; median eyes more than their diameter from the lower edge of the clypeus (about once and a fourth), the laterals nearly once and two thirds their diameter from it. Diameter of eyes of second row exceeding that of the anterior medians in about ratio 5:2; eyes of second row more than their radius apart (about three fifths diameter), less than their radius from anterior medians (two fifths diameter). Posterior eyes a little smaller than the second, three and a half or a little more times their diameter apart. Quadrangle of posterior eyes contained in total length of cephalothorax about 3.75 times. Area of median eyes much wider than long (48: 34), wider behind than in front (12:5).

Total length of sternum exceeding the width in ratio 8.5–9:7, (Plate **22**, fig. 8).

Labium wider than long, (Plate **22**, fig. 7).

Upper margin of furrow of chelicera with the usual three teeth; lower margin with four teeth of which the third from the distal end is much the smallest, the other three stout, conical, equal, (Plate **22**, fig. 9).

Anterior tarsi and metatarsi scopulate to base; the posterior metatarsi scopulate lightly on distal portion only. Tibia I with five pairs of ventral spines, these being very long, the first or basal ones overlapping bases of those of the third pair, the distal spines much shorter than those of first and second pairs; also a short spine on anterior and one on posterior face. Metatarsus I with three pairs of ventral spines of which the first two pairs are very long like those of the tibiae; also with three spines on anterior and three on posterior surface and a pair of dorsal ones near distal end.

Anterior piece of lorum of pedicel notched behind, the posterior piece rounded anteriorly and fitting into the notch.

Process of tibia of palpus in male ventral in position; subconical and low in specimen lacking one moult of maturity.

Male. Length, 9 mm. Length of cephalothorax, 3 mm.; width, 2.5 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	3.1 mm.	4 mm.	2.1 mm.	1.3 mm.	10.5 mm.
Leg II	3.1	3.8	2.1	1.3	10.3
Leg III	2.3	3	2	1.1	8.4
Leg IV	3.7	4	3	1.3	11.0

Locality.— Huadquina, 5,000 feet, July. (Type, M. C. Z., 322, male lacking apparently one moult of maturity; paratype, M. C. Z., 268, one male in same stage as type).

LYCOSIDAE.

PORRIMA HARKNESSI, sp. nov.

Plate **23**, fig. 2–6.

Carapace with integument from light brown to darker, nearly chocolate-brown; the lateral margins black with a pale supramarginal, stripe on each side; eye-region blackish; a pale median longitudinal line extending from the eye-area caudad and on each side of this a pale or whitish line converging toward the corresponding one of the opposite side with which it unites caudad of the stria. Sternum dark brown to blackish, paler about margin and with a pale median longitudinal mark in the anterior portion. Labium dusky, paler across the distal end. Endites lighter brown. Chelicerae dark brown to somewhat mahogany color. Legs dilute testaceous to dark brown or dusky brown. Abdomen above almost black, the blackish area limited on each side by a clear white line from which, beginning near middle, a series of very short lines are given off on the inner side and extend a little cephalad of mesad; sides and venter paler, from dusky testaceous to nearly black; the venter showing a vague pale longitudinal line on each side. The light lines of carapace and abdomen clothed densely with white hairs, the margin of carapace also clothed with white hair, the hair of other parts dark.

Carapace with dorsal line in profile nearly horizontal, a little depressed at the groove; pars cephalica anteriorly very narrow.

Anterior row of eyes strongly procurved, much longer than the second row (posterior medians) but shorter than the third (posterior laterals); median eyes much smaller than the laterals (diameters nearly as 2:3), about their radius apart and about half as far from the laterals; lateral eyes not fully their radius from the lower edge of clypeus. Eyes of the second row but slightly larger than the anterior lateral eyes, about their radius apart. Eyes of the third row clearly smaller than those of the second, their diameters being as 4:5; each its diameter from corresponding eye of the second row, a little more than three times their diameter apart. Cephalothorax between six and a half and seven times as long as area of the two posterior rows of eyes.

Labium a little longer than wide (28:25), reaching a little distad of middle of endites; proximal notches long; distal margin wide, a little incurved, (Plate **23**, fig. 2).

Sternum but little longer than wide, convexly rounded in front; caudally ending in a short acute process between the last coxae.

Chelicerae long and cylindrical, not very stout; lower margin with three subequal teeth; upper margin with three teeth of which the median is largest as usual.

Tibiae I and II with three pairs of ventral spines of which the first two are very long and appressed, the distal pair much shorter; two spines on anterior and two on posterior surface. Femur I with three spines in middorsal line and with two on the anterior side of this and three on the posterior. Patellae I and II unarmed; III and IV with a spine on anterior and one also on posterior surface. Paired claws with mostly eleven or twelve long teeth, these a little curved distad; unpaired claw with two short teeth at base, (Plate **23**, fig. 6).

Male (*Type*). Length, 15 mm. Length of cephalothorax, 7 mm.; width, 5 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	7 mm.	8.5 mm.	5.7 mm.	3.5 mm.	24.7 mm.
Leg II	6.9	8	5.6	3.5	24.0
Leg III	6.7	7	5.5	3	22.4
Leg IV	7.5	9	8.3	4	28.8

Tibia I, 5.25 mm. Tibia IV, 6.8 mm.

Female. Length, 13.3 mm. Length of cephalothorax, 6 mm.; width, 4.6 mm.

	fem.	tib +pat.	met.	tar.	total
Leg I	5.9 mm.	5.9 mm.	4.2 mm.	3 mm.	19.0 mm.
Leg II	5.1	6.1	4.1	2.8	18.1
Leg III	5	5.3	4	2.2	16.5
Leg IV	6.2	7	6.6	3.1	22.9

Tibia I, 4.9 mm. Tibia IV, 5.2 mm.

Locality.— Huadquina, 5,000 feet, July 26. (Type, M. C. Z. 269, male; paratypes, M. C. Z. 270, one male and one female).

Named for Edward S. Harkness of New York, a patron of the expedition.

Lycosa securifer Tullgren.

Arkiv. f. zool., 1905, **2**, p. 66, pl. 8, f. 32.

The specimens here listed are, with slight doubt, referable to *L. securifer* described by Tullgren from Argentina.

Localities.— Cuzco, 11,500 feet, July. (M. C. Z. no. 271, one adult female with egg sac and one immature female taken under stone). Urubamba, 9,500 feet, July. (M. C. Z. 272).

Lycosa gumia Petrunkevitch.

Lycosa gulosa Tullgren, Arkiv. f. zool., 1905, **2**, p. 63, pl. 8, f. 30.
Lycosa gumia Petrunkevitch, Bull. Amer. mus. nat. hist., 1911, **29**, p. 560.

Localities.— Tincochaca, 7,000 feet, August. (M. C. Z. 273, six females). San Miguel, 6,000 feet, July. (M. C. Z. 274, one female).

Lycosa thorelli (Keyserling).

Tarentula thorelli Keyserling, Verh. Zool. bot. ges. Wien, 1876, **26**, p. 650, pl. 1, f. 28.

Localities.— Huadquina, 5,000 feet, July. (M. C. Z. 275, one female). Lucma, 7,000 feet, August. (M. C. Z. 276, one female adult, and one immature female).

Lycosa sp. a.

An immature male of doubtful species collected at Paltaybamba, 5,000 feet, August 27. (M. C. Z. 277).

Lycosa sp. b.

An immature male from Panama, June. (M. C. Z. 278). It is near *L. dilatata* F. Cambridge, but is probably undescribed.

Lycosa sp. c.

An immature female from Ollantaytambo, 9,000 feet, July. (M. C. Z. 279).

Lycosa sp. d.

An immature female of uncertain species from Santa Ana, 3,000 feet, August. (M. C. Z. 280).

Lycosa sp. e.

An immature female from the Conservidayo River collected in August. (M. C. Z. 281).

Lycosa liopus,[1] sp. nov.

Plate **24**, fig. 4.

Carapace with sides brown, a supramarginal stripe on each side and a broad median longitudinal stripe light testaceous, the latter stripe narrowed between eyes and again gradually narrowing caudad, not distinctly constricted in front of the groove; lateral margins dusky. Hair of the light stripes when dry grey or somewhat brownish grey. Sternum and legs light testaceous, the femora of legs beneath paler, more yellow; legs without any markings. Labium dusky except across tip. Endites light chestnut, tips pale. Chelicerae chestnut. Venter of abdomen yellow, dorsum and sides darker, especially across anterolateral corners; dorsum with a median wedge-shaped black mark at base, the mark abruptly narrowed into a narrow tongue caudad.

Anterior row of eyes shorter than the second; clearly procurved median eyes with diameter larger than that of laterals in ratio 16:13, their radius apart and only half as far from the laterals. Anterior median and anterior lateral eye each its diameter from the lower margin of clypeus. Eyes of second row greatly exceeding those of the first, their diameter being to that of the anterior medians as 2:1; not fully two thirds their diameter apart (9/16) scarcely one third their diameter from anterior median eyes. Eyes of third row about seven eighths the diameter of the second, between 2.25 and 2.5 times their diameter apart. Length of cephalothorax to length of area of four posterior eyes as 4.75:1.

Lower margin of furrow of chelicerae with the usual three teeth, these stout, conical, and subequal.

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[1] λεῖος, smooth, πούς, foot.

Sternum 2.8 mm. wide and 3.8 mm. long.

Anterior tarsi and metatarsi scopulate to the base, the tibiae also scopulate at distal end; posterior metatarsi only sparsely scopulate distad. Tibia I with ventral spines as usual, moderate in size, the basal spines largest, a little overlapping those of the second pair; on anterior side with two (or on one side with three) spines the posterior side with none; spines of tibia II the same excepting there are two anterior spines on both right and left legs in type and there is on one side a minute distal spine on the caudal side.

Female. Total length, 15.5 mm. Length of cephalothorax, 8.1 mm.; width, 6 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	5.2 mm.	6.4 mm.	4 mm.	2.8 mm.	18.4 mm.
Leg II	5.1	6.4	3.9	2.8	18.2
Leg III	5.1	5.7	4.2	2.5	17.5
Leg IV	6.3	7.1	6.1	3.25	22.75

Tibia I, 4 mm. Tibia IV, 4.7 mm.

Locality.— Santa Ana, 3,000 feet, August. (Type, M. C. Z. 282, one female).

LYCOSA ORINUS,[1] sp. nov.

Plate **24**, fig. 1.

Carapace with integument dark brown, a supramarginal pale stripe on each side and a broad median longitudinal testaceous stripe extending from between eyes to the caudal margin, this stripe constricted a little in front of the groove and narrowing down the posterior declivity; the pale stripes, and the border beneath the lateral ones as well, clothed with bronze-brown hair intermixed, especially in the eye-region, with black bristles; hair of other parts of carapace darker. Sternum black. Labium and endites deep chestnut or blackish, pale across the tip. Chelicerae black clothed in front below with orange hair. Legs testaceous to brown, the coxae beneath all black; femora I and II also black beneath but femora III and IV merely with a black stripe across distal end beneath; all patellae black beneath; all tibiae with a broad black band across distal end; the anterior metatarsi black beneath, the posterior metatarsi black at the distal ends, the hair of black areas of legs black, of the other parts above brown with darker longer bristles intermixed in the usual way, but the light areas beneath clothed with more grey colored hair. Abdomen beneath solid black; sides grey-brown; dorsum very dark brown, dusky, a median blackish wedge-shaped mark outlined by light lines in the front third of the length, this followed by a series of black chevron-lines each bordered caudad by a light line which commonly terminates at each end in a light spot, the light lines clothed with hair which is yellow when dry, there being other spots and streaks of same as well.

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[1] 'ορεινός, mountaineer.

Cephalothorax in profile with the dorsal line rising gradually and moderately from the posterior declivity to the third eyes.

Anterior row of eyes a little shorter than the second (17:18), procurved as usual; medians larger than the laterals (diameters as 19:16) scarcely their radius apart, nearer to the laterals; median eye separated from eye of second row of same size by a distance equal to diameter of lateral eye; anterior lateral eye once and a fourth their diameter from lower edge of clypeus. Eyes of second row with diameter fully twice that of anterior medians, about five eighths their diameter apart. Posterior eyes with diameter three fourths that of the second eyes, not quite three times their diameter apart. Area of four posterior eyes just one fifth total length of carapace.

Sternum broadly elliptic, three fourths as wide as long.

Anterior tarsi and metatarsi and distal end of tibiae densely scopulate; posterior metatarsi scopulate only at distal end. Anterior tibiae with the usual three pairs of spines beneath, these very short as are also the small spines on the anterior and posterior surface.

Female. Length, 18.5 mm. Length of cephalothorax, 9.4 mm.; width, 7 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	7.1 mm.	8.1 mm.	5 mm.	3.5 mm.	23.7 mm.
Leg II	6.5	7.3	5	3	21.8
Leg III	6	6.8	4.6	3	20.4
Leg IV	7.8	8.8	7.0	3.7	24.3

Locality.— Cuzco, 11,500 feet, July 6, 7. (Type, M. C. Z. 283; paratypes M. C. Z. 284, two mature and one immature females and three immature males).

Lycosa andina, sp. nov.

Plate **24**, fig. 2–3.

Carapace dark brown, a broad median longitudinal stripe from eyes caudad and narrowing to caudal edge testaceous, this stripe limited as far back as the thoracic furrow by a narrow black line; a narrow pale supramarginal stripe on each side. Sternum, labium, endites, and coxae of legs beneath deep blackish brown in alcohol or dense blackish when dry. Chelicerae black; a dense coat of orange colored hair on anterior face, especially distally. Legs brown, femora paler beneath; patella black across ventral surface; tibiae with a broad black band across distal end on ventral half. Abdomen grey-brown, venter wholly dusky; dorsally with a median longitudinal black stripe at base this first clavately widening and then abruptly narrowed to continue as a narrow tongue to middle where it bifurcates in two narrow pointed branches; caudad of this mark two or three slender black chevron-marks are usually distinctly indicated. The male is colored similarly to the female but the venter back of the genital furrow is solid black and the abdomen in a stripe across each anterolateral corner and caudad along side of abdomen is also black.

Cephalothorax in profile with the dorsal line convex, very little rising cephalad of the groove.

Anterior row of eyes procurved, equal in length to the second; median eyes decidedly larger than the laterals (diameters as 4:3), rather less than their radius apart, closer to the laterals; anterior medians about their diameter from lower edge of clypeus. Eyes of second row with diameter larger than that of anterior median eye in about ratio 18:11, nearly two thirds their diameter apart. Eyes of third row smaller than those of the second (diameters nearly as 5:6); about five sixths their diameter from eyes of second row, more than twice their diameter apart. Cephalothorax between 7.25 and 7.5 times longer than the quadrangle of the second and third eye rows.

The three teeth of the lower margin of furrow of chelicera long, conical, stout, the most proximal one a little largest.

Distal edge of labium broad, very slightly incurved from end to end.

Sternum semicircular, longer than wide in about ratio 3.1:2.9.

All tarsi and metatarsi scopulate to base; anterior tibiae also densely scopulate over distal half or more. Anterior tibiae with the usual ventral spines only; posterior tibiae in addition to the ventral spines with two spines in the middorsal line and with two each on the anterior and posterior side above.

Male. (Type, *Tincochaca*). Length, 24.5 mm. Length of cephalothorax, 9 mm.; width, 6.2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	6.8 mm.	8.3 mm.	6 mm.	3.5 mm.	24.6 mm.
Leg II	6	7.3	4.2	3.1	20.0
Leg III	5.4	6	4.2	3	14.6
Leg IV	7.3	8.8	7.2	4.0	27.3

Tibia I, 5.2 mm. Tibia IV, 5.6 mm.

Female (*Torontoy*). Length, 24.5 mm. Length of cephalothorax, 9 mm.; width, 6.2 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	6.5 mm.	8 mm.	5 mm.	3.2 mm.	22.7 mm.
Leg II	6	7.3	4.2	3.1	20.7
Leg III	5.4	6	4.2	3	18.6
Leg IV	7.3	8.8	7.2	4	27.3

Tibia I, 5 mm. Tibia IV, 7 mm.

Localities.— Tincochaca, 7,000 feet, August. (Type, M. C. Z. 285, male; paratype, M. C. Z. 286, female). Lucma, 7,000 feet, August. (M. C. Z. 287, six specimens). Torontoy, 8,000 feet, July. (M. C. Z. 288, one female). Urubamba, 9,500 feet, July. (M. C. Z. 289, one immature female).

Lycosa algina,[1] sp. nov.

Plate **24**, fig. 5–6.

Sides of carapace blackish brown; the usual pale supramarginal line on each side extending forward to pars cephalica; a median longitudinal pale stripe extending from between eyes which are enclosed in black, to caudal margin, this being a little constricted at a point between eyes and groove, narrowing down posterior declivity as usual. Sternum yellow with a solid black median longitudinal stripe across the entire length. Chelicerae testaceous with a few, in part obscure, blackish longitudinal lines. Coxae of legs beneath yellow. Leg I partly regenerated and not normal nearly clear yellow, markings obscure. Other legs with femora marked by four wavy or serrate edged black annuli; patellae nearly entirely blackish; tibiae with two broad black bands leaving between them only a narrow circle of yellow at the middle; metatarsi with three broad black annuli; tarsi without dark bands.

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[1] ’αλγεινός, giving pain.

Abdomen beneath yellow, black at base of spinnerets; sides above finely densely spotted with black, the spots fewer below, a black patch on each anterolateral corner; dorsum pale in a band about a black basal mark and also paler transversely at caudal end and in a narrow median line connecting with the anterior light area.

Carapace moderately high, the posterior declivity steep; dorsal line in profile a little depressed at dorsal groove.

Anterior row of eyes distinctly shorter than the second (9:10); moderately procurved; median eyes clearly less than their radius apart (four elevenths of diameter), closer to the laterals, their diameter exceeding that of the laterals in about the ratio 11:9. Anterior median eyes separated from the lower edge of clypeus by less than their diameter (about 8:11). Eyes of second row not quite twice the diameter of the anterior median eyes, more than their radius apart (about thirteen twentieths of diameter); separated from anterior median eyes by about the radius of the latter. Area of median eyes wider than long in ratio 10:7; wider behind than in front in ratio 2:1. Eyes of third row distinctly smaller than the second (diameters about as 9:11), near 2.22 their diameter apart. Cephalothorax only 3.96 times longer than area of posterior eyes.

Spines of anterior tibiae and metatarsi as usual in number; the first two pairs very long, the distal ones much shorter.

Labium a little wider than long (15:14); notches about one third the total length, (Plate **24**, fig. 5).

Male. Length, 7 mm. Length of cephalothorax, 4 mm.; width, 3 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	—	—	—	—	—
Leg II	3.2 mm.	4 mm.	2.6 mm.	1.4 mm.	11.2 mm
Leg III	3	3.5	3	1.6	11.1
Leg IV	4	4.8	4.8	2.2	15.8

Tibia IV, 3.1 mm.

Locality.— Paltaybamba, 5,000 feet, August. (Type, M. C. Z. 290).

A species in several respects much like a Pardosa rather than a Lycosa. The palpal organ of the male has the structure typical of a Lycosa.

ARCTOSA ALTAMONTIS, sp. nov.

Plate **23**, fig. 7–9.

Carapace with the usual wide median pale spot back of the eyes with radiating lines down the sides, this area abruptly narrowed at caudal end of thoracic groove and running as a much narrower tongue down the posterior declivity; on each side above the black margin a series of large, in part confluent light spots, the row bending up to the third eye on each side. Eye-area black excepting for short tongue of light color between the third eyes. The light areas clothed with grey hair. Sternum black. Labium black except distally. Endites testaceous. Chelicerae brown or light testaceous. Legs yellow, closely annulate with black, the annuli commonly incomplete below and often broken into spots; femora with four dark rings of which the most distal is proximad of the end; papilla with one ring at proximal end; tibia with two rings and metatarsus with three. Abdomen with venter and lower part of sides clear greyish yellow; a dusky band over each anterolateral corner broken into irregular spots farther caudad; at base with a median longitudinal lanceolate mark of brown with two small triangular black marks on the edge of each side; basal mark followed behind by a series of pairs of dark, often indistinct, marks which may in part be confluent.

Cephalothorax low. Head rather broad with sides of face sloping outward as usual; the eyes removed from lateral edges of the head.

Anterior row of eyes clearly shorter than the second (38:45); a little procurved; median eyes decidedly larger than the laterals (ratio of diameters as 10:7), three fifths their diameter apart, not fully a third as far from the laterals. Clypeus narrower than the anterior median eyes (about three fifths as wide). Eyes of the second row one and three fifths the diameter of an anterior median eye; their diameter or very nearly so, apart. Third eyes each slightly smaller than the second (about as 15:16 in diameters), just twice their diameter apart. Quadrangle of posterior eyes much wider behind than in front (57:45), wider than long (57:48); length to that of cephalothorax nearly as 1:4.

Upper margin of furrow of chelicera with the three teeth as usual; lower margin with three stout conical teeth which commonly decrease in size proximad.

Labium a little longer than wide (17:16); notches one fourth the total length; sides convex, converging distad; distal margin widely weakly incurved.

Scopulae of tarsi as usual, those of the anterior tarsi entire though not dense, those of the posterior pairs more sparse and divided by a wide setose band. Tibia I with the usual three pairs of ventral spines; tibia II with the usual distal pair of spines but with single median and basal spines toward caudal side, in place of the usual pairs. No median dorsal spine at base of posterior tibiae, this as usual represented merely by a long bristle in each case. Patellae not armed in median dorsal line.

Female. Length, 10 mm. Length of cephalothorax, 4 mm.; width, 3.1 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	3 mm.	3.6 mm.	2.1 mm.	1.8 mm.	10.5 mm.
Leg II	3	3.1	2.1	1.7	9.9
Leg III	2.7	3.1	2.3	1.7	9.8
Leg IV	4	4.3	3	2.1	13.4

Tibia I, 2 mm.

Length of male, 8 mm.; length of cephalothorax, 3.8 mm., width, 2.7 mm.

Localities.— Cuzco, 11,500 feet, July. (Type, M. C. Z. 291, female; paratypes, M. C. Z. 292, numerous females). Arequipa, 7,600 feet, June 28. (M. C. Z. 323, one female). Urubamba, 9,500 feet, July. (M. C. Z. 293, on male, two females).

ORINOCOSA,[1] gen. nov.

Cephalothorax much as in Lycosa, but with sides of head steeper.

Anterior eyes small, the medians larger than the laterals to which they are closer than to each other; anterior row much shorter than the second, strongly procurved. Eyes of second row large, less than their diameter apart. Quadrangle of posterior eyes wider behind than in front (in type species the length of quadrangle is to length of cephalothorax as 1:3.6 or 3.7).

Clypeus receding from median eyes; narrow, but equal in width to diameter of an anterior median eye.

---

[1] Greek ’ορεινός, mountaineer, *Lycosa*.

Upper margin of furrow of chelicera with three teeth of which the median is longest; lower with three teeth of which the most proximal may be reduced.

Labium as wide as long or nearly so. Basal notch in type short, about one fourth the total length.

Legs distally slender. Metatarsus IV equal in length to tibia C + patella IV. Tarsi setose beneath, none truly scopulate. Tibia I with three pairs of ventral spines, the distal reduced, the first two but slightly exceeding the diameter of the joint. Tibiae III and IV above with a stout median apical spine and a median basal spine.

Epigynum with median guide and transverse arms; lateral cavities deeper cephalad as in Lycosa.

Genotype.—*Orinocosa aymara*, sp. nov.

Most readily distinguished from related genera by presence of the stout median dorsal spines on the posterior tibiae. Its affinities seem to be closest with Lycosa.

ORINOCOSA AYMARA, sp. nov.

Plate **24**, fig. 7–8.

Carapace with sides nearly black; on each side a narrow, supramarginal light line which does not reach upon pars cephalica; median pale stripe beginning back of second eyes extending between third behind which it widens to width of eye-area, then abruptly narrower some distance in front of the thoracic furrow and gradually narrowing to caudal margin, the stripe embracing a dark mark back of each eye of the third row. Sternum black, with a median longitudinal yellow mark in the anterior half. Labium dusky. Endites brown or somewhat chestnut. Chelicerae light chestnut. Coxae of legs beneath yellow; other joints yellow, with exception of tarsi closely ringed with black, there being three distinct annuli on femora of which the distal is very broad and two on the tibia of such breadth that only a small ring of yellow remains at the middle; metatarsus also with two broad rings nearly embracing the whole length. Venter of abdomen brown, black at base of spinnerets; sides with a few black spots; a large solid black spot over each antero-lateral corner; dorsum greyish yellow covered with a very fine areolation in dark, embracing a short, faint lanceolate outline at base which sends off a pair of short side branches at tip and one on each side near middle, behind tip of lanceolate mark a small triangular black spot and on each side of dorsal light area two black spots of which the most anterior is on a level with tip of lanceolate mark.

Anterior row of eyes much shorter than the second (33:48); strongly procurved; laterals with diameter three fourths that of the median; medians their radius apart and half as far, or scarcely more, from the laterals. Clypeus conspicuously receding; width about equal to diameter of median eye. Eyes of second row more than twice the diameter of an anterior median eye (about 5:2), not quite three fourths their diameter apart (about 10:7), one fourth their diameter from anterior median eyes. Area of median eyes very much wider than long (ratio about 16:9), wider behind than in front in ratio 48:17, or nearly three times. Eyes of third row clearly smaller than those of the second (diameters about as 17:20), less than 2.5 times their diameter, apart. Area of posterior eyes to total length of carapace nearly as 1:3.6 or 3.7.

Labium nearly as wide as long; basal notches one fourth or but little more of the total length of labium, (Plate **24**, fig. 7).

Sternum about six sevenths as wide as the total length.

Lower margin of furrow of chelicera with three stout teeth of which the most proximal may be smaller than the others; upper teeth as usual.

Spines of anterior tibiae and metatarsi as usual in Pardosa or nearly so. Patellae of posterior legs with a spine not only on each lateral surface but also with two dorsal spines, one basal and one strictly distal.

Tibia IV with spine at base above. None of tarsi scopulate, strongly setose beneath. Paired claws with about 10, closely set teeth.

Female. Length 6 mm. Length of cephalothorax 3.2 mm.; width, 2.1 mm.

	fem.	tib.+pat.	met.	tar.	total
Leg I	2.1 mm.	2.7 mm.	1.8 mm.	1.2 mm.	7.8 mm.
Leg II	2	2.3	1.4	1.1	6.8
Leg III	2	2.1	1.7	1	6.8
Leg IV	3	3.1	3	1.8	10.9

Localities.— Santa Ana, 3,000 feet, August. (M. C. Z. 294, one female). Huadquina, 5,000 feet, July. (M. C. Z. 295).

OXYOPIDAE.

OXYOPES SALTICUS Hentz.

Boston journ. nat. hist., 1845, **5**, p. 196, pl. 16, f. 10.
O. varians Taczanowski, Horae Soc. ent. Roos., 1873, **10**, p. 95.
O. gracilis Keyserling, Verh. Zool. bot. ges. Wien, 1877, **27**, p. 698, pl. 2, f. 63, 64. O. P. Cambridge, Biol. Cent. Americana, 1902, **2**, p. 342, pl. 32, f. 14, 15.

Localities.— Santa Ana, 3,000 feet, August. (M. C. Z. 332, five females and one male.

Panama, June. M. C. Z., 333, three females and one male).

PEUCETIA RUBRALINEATA Keyserling.

Verh. Zool. bot. ges. Wien., 1876, **26**, p. 704, pl. 2, 70, 71.

Localities.— Near Paltaybamba, 6,000 feet, August. (M. C. Z. 334, one female). Huadquina, 5,000 feet, July. (M. C. Z. 335, two females and one male).

TAPINILLUS sp. a.

Two immature specimens of uncertain species).

Locality.— San Miguel, 6,000 feet, July. (M. C. Z. 336).

TAPINILLUS, sp. b.

An immature specimen of uncertain species.

Locality.— Huadquina, 5,000 feet, July. (M. C. Z. 337).

SALTICIDAE.

DENDRYPHANTES BISQUINQUEPUNCTATUS Taczanowski.

Bull. Soc. imp. nat. Moscow, 1878, p. 309.

Locality.— Paltaybamba, originally described from Pumamarca, Peru, 5,000 feet, August. (M. C. Z. 296, one male).

DENDRYPHANTES ANDINUS, sp. nov.

Plate **25**, fig. 5, 6.

Carapace with integument reddish brown, darker cephalad, but covered in life with hair and scales in a broad median longitudinal band of metallic green color, this band being as wide cephalad as the eye-area and narrowing strongly caudad, and in a wide supramarginal band of white hair on each side. Chelicerae chestnut. Sternum, labium, and endites brown; coxae of legs beneath yellow; other joints of legs yellowish or testaceous, each with a black annulus at distal end, but the first pairs darker, dusky chestnut throughout. Abdomen above encircled with a stripe of white hair and along median portion five pairs of small white dots outside of which are black dots, the dorsum elsewhere being clothed with scales of the metallic green lustre; venter brown, limited on each side with a line of white hair; sides clothed with white and green hair intermixed.

Ocular quadrangle wider behind than in front (12:11) and wider than long as usual. Eyes of second row minute, situated considerably in front of the middle. Anterior row of eyes strongly recurved; median eyes with diameter two and a third that of the laterals, one seventh diameter apart and about same distance from the laterals.

Length of male 6.3 mm.; length of cephalothorax 3 mm., width, 2.2 mm.

Locality.— San Miguel, 6,000 feet, July. (M. C. Z. 297, one male).

DENDRYPHANTES CALUS,[1] sp. nov.

Plate **25**, fig. 7, 8.

Carapace with integument black or nearly so, a wide supramarginal stripe of white scales on each side. Chelicerae black, the claws brown. Sternum black. Coxae of legs testaceous; femora and tibiae of leg I black, patella black distally, testaceous proximally, distal half of metatarsus I black, testaceous proximally, tarsus testaceous; other legs paler, more yellowish, with narrow annulus of black at distal end of each. Abdomen in life with the dorsum black, a band of white hair across anterior surface and continuing half way back along the sides, with three narrow lines of white extending from sides a short distance mesad on the dorsum on each side at and caudad of the middle; venter brown.

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[1] καλός, beautiful.

Ocular quadrangle much wider than long and wider behind than in front in the usual way. Second eyes minute and well in front of the middle. Eyes of first row about as in the preceding species.

Chelicerae long and slender; the claw slender and as long as the chelicera, with a double curve; tooth of lower margin bent conspicuously toward distal end of chelicera, (Plate **25**, fig. 8).

Tibia I with two pairs of ventral spines toward distal end and a single ventral spine toward ectal side well toward base of joint. Metatarsus I with two pairs of ventral spines, one distal and one at middle.

Length, 5.1 mm.; length of cephalothorax, 2.5 mm., width, 1.9 mm.

Localities.— Santa Ana, 3,000 feet, August. (Type, M. C. Z. 298, male; paratype, M. C. Z. 299, one male). San Miguel, 6,000 feet, July. (M. C. Z. 331, one male). Paltaybamba, 5,000 feet, August. (M. C. Z. 300, one male). Huadquina, 5,000 feet, July. (M. C. Z. 301, an immature female).

DENDRYPHANTES AMPHIBOLUS,[1] sp. nov.

Plate **25**, fig. 9.

Carapace with integument reddish black, clothed over whole surface with white scales of greenish lustre. Sternum and labium brownish black, the endites a paler brown. Legs yellowish or pale testaceous, the femora, patellae, tibiae, and metatarsi typically dark at tips, at least ventrally, but the annuli may be clearly evident only on the posterior pairs. Abdomen above with several pairs of large brown spots the most anterior of which are confluent across anterior end and with less distinct chevron-lines between caudal ends of others; in the elongate yellowish grey area between anterior pairs of spots is a longitudinal brown line or mark bisecting the same; the hair across the anterior face and bordering the brown spots is white; venter dilute yellowish grey, with or without three longitudinal brown lines on the caudal portion. Spinnerets narrowly enclosed at base with brown.

Tibia I (female) with two pairs of short spines toward the distal end and one ventral spine on the ectal or caudal side toward the base; metatarsus I with two pairs of spines, one distal and one mesal.

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[1] 'αμφίβολος, ambiguous.

Tooth of lower margin of chelicera (female) short, stoutly conical, acute; teeth of upper margin two, small (or an obsolete third tooth may be present).

Ocular quadrangle much wider than long, conspicuously wider behind than in front, with the minute second eyes in front of the middle as usual. Eyes of the first row as in the preceding species.

Length of female 5 mm.; length of cephalothorax 2 mm.; width, 1.4 mm.

Localities.— Huadquina, 5,000 feet, July. (Type, M. C. Z. 302, female; paratypes, M. C. Z. 303, six females). Paltaybamba, 5,000 feet, August. (M. C. Z. 304, three females).

DENDRYPHANTES sp. a.

A female from Huadquina, 5,000 feet, July. (M. C. Z. 309) cannot be satisfactorily determined.

DENDRYPHANTES sp. b.

An immature female of doubtful species from San Miguel, 6,000 feet, July. (M. C. Z. 310).

WALA sp.

An immature male and female of uncertain species from San Miguel, 6,000 feet, July. (M. C. Z. 305).

WALA NODA,[1] sp. nov.

Plate **25**, fig. 2.

Carapace with integument brownish black, rubbed in part but apparently clothed in life with greyish scales which on the head are more brownish. Legs brown. Sternum brownish black. Abdomen grey-brown beneath. Above clothed with light grey scales except for two pairs of elongate subtriangular dark areas of which the apices are directed forwards and the edges are curved; a narrow chevron-mark between the two pairs of dark spots.

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[1] *νωδός*, edentate.

Lower margin of furrow of chelicera unarmed or with but a minute pale rudiment of a tooth.

Tibia I armed beneath with three pairs of spines; metatarsus I with two longer pairs; tibia II beneath with an apical pair and a single spine toward middle in the usual way.

Ocular quadrangle much wider than long (13:9), fully as wide in front as behind. Eyes of second row slightly in front of the middle.

Length of female, 6 mm.; cephalothorax, in length, 2.8 mm.; width, 1.8 mm.

Locality.— Torontoy, 8,000 feet, July 22. (Type, M. C. Z. 306, female; paratype, M. C. Z. 307, one female).

One female from the Conservidayo River in bad condition is this species or very close to it.

EVOPHRYS CRUX Taczanowski.

Bull. Soc. imp. nat. Moscow, 1878, p. 284.

Described originally from Amable Maria, Peru.

Locality.— Tincochaca, 7,000 feet, August. (M. C. Z. 311, female).

EVOPHRYS PERUVIANA Taczanowski.

Bull. Soc. imp. nat. Moscow, 1878, p. 280.

Previously known from Amable Maria and Pumamarca, Peru.

Locality.— Conservidayo River, August. (M. C. Z. 312, four females).

EVOPHRYS sp. a.

Locality.— Santa Ana, 3,000 feet, August. (M. C. Z. 313, one immature female).

EVOPHRYS sp. b.

Locality.— Santa Ana, 3,000 feet, August. (M. C. Z. 314, one immature female).

EVOPHRYS sp. c.

Locality.— Lucma, 6,000–7,000 feet, August. (M. C. Z. 315, one immature male in coloration much like *E. crux* Tacz.).

EVOPHRYS SIMA,[1] sp. nov.

Plate **25**, fig. 1.

Carapace with a broad median longitudinal light band anteriorly as broad as the ocular quadrangle but narrowing caudad to a point at the caudal edge, this band reddish on head and becoming yellow caudad; sides blackish brown with a narrow supramarginal pale stripe on each side. Sternum yellow. Last three pairs of legs yellow; first pair of legs with femora reddish brown, more yellow distally, the more distal joints light brown, the metatarsus clothed with a brush of long spatulate hairs on ventral surface, similar but more sparse ones on ventral surface of femur and patella. Palpi reddish brown, the femur with numerous white hairs above and with black scopulate hairs below which also occur on other joints. Dorsum of abdomen black with a narrow median longitudinal yellow stripe over the entire length, the edges of this stripe dentate along caudal half of length; sides yellow finely dotted with black and a more solid stripe below at the anterior end; venter yellow with a few dots at the sides. Spinnerets dusky.

Tibia I with the usual three pairs of ventral spines; one small spine toward the distal end on lower anterior surface. Metatarsus I with two pairs of spines as usual.

Ocular quadrangle a little wider in front than behind and rather more than one fourth wider than long. Eyes of second row caudad of middle. Eyes of first row nearly contiguous, medians twice the diameter of the laterals.

Length of male, 4 mm. Length of cephalothorax, 2.2 mm.; width, 1.6 mm.

Locality.— San Miguel, 6,000 feet, July. (M. C. Z. 316, one male).

PHIALE PANAMAE, sp. nov.

Plate **25**, fig. 4.

Carapace black with a reddish yellow median longitudinal stripe crossed by a black band at level of the third eye row and narrowing to the posterior margin; also a reddish supramarginal stripe on each side. Sternum yellow, dusky at margins. Legs and palpi dusky brown, the posterior pairs somewhat paler. Spinnerets and venter of abdomen dusky; dorsum black, the anterior face and anterolateral corners and sides whitish, three pale spots in a triangle near middle and several fainter, smaller ones farther caudad.

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[1] Gosiute *sima*, one.

Ocular quadrangle slightly wider in front than behind; eyes of second row minute, behind middle. First row of eyes decidedly recurved; eyes contiguous or nearly so, the median eyes with diameter two and a half times that of the laterals.

Femora I and II with three moderately long spines at the distal end on anterior part of dorsal surface and with two spines in the middorsal line farther proximad. Tibia I with the usual three pairs of rather short ventral spines and two on anterior surface; metatarsus I with two pairs of ventral spines and one on anterior surface at the distal end.

Tibia of palpus with apophysis at distal end from dorsoectal corner subconical, distally curved.

Length of male, 4 mm.; length of cephalothorax, 2.1 mm.; width, 1.3 mm.

Locality.— Panama, June. (M. C. Z. 317, one male).

PHIALE HUADQUINAE, sp. nov.

Plate **25**, fig. 3.

Carapace with integument solid shining black, a band of white hair along each side. Sternum and mouthparts also black, the endites pale across tips. Last two pairs of coxae yellowish beneath, the anterior pairs darker; femora, patellae, and tibiae black. Metatarsus black distally, testaceous proximally; tarsi testaceous. Integument of abdomen black clothed with hair of golden brown lustre; hair of venter grey.

Lower margin of furrow of chelicera with one stout tooth; upper margin with two teeth united at base.

Ocular quadrangle wider in front than behind (46:43). Eyes of second row minute, at middle of length of quadrangle or scarcely in front. Anterior row of eyes strongly recurved; median eyes a little more than twice the diameter of the lateral, about one seventh their diameter apart and from the laterals.

Tibia I with three pairs of spines below and three single ones on anterior surface; metatarsus with two pairs beneath.

Length of male, 7 mm.; length of cephalothorax, 3.1 mm.; width, 2.1 mm.

Locality.— Huadquina, 5,000 feet, July. (M. C. Z. 318, one male).

PLATE 1.

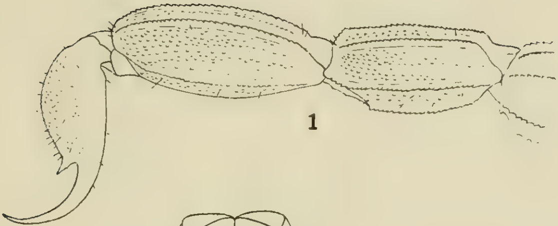
PLATE 1.

Tityus footei Chamberlin.

Fig. 1. Lateral view of sting and last two segments of abdomen.
Fig. 2. Finger, inner surface, showing arrangement of granules.
Fig. 3. Tarsus IV, anterior view.
Fig. 4. Comb.

Brachistosternus andinus Chamberlin.

Fig. 5. Carapace, dorsal view.
Fig. 6. Finger, inner view, showing granules.
Fig. 7. Tarsus IV.
Fig. 8. Comb.



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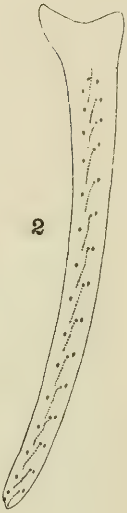

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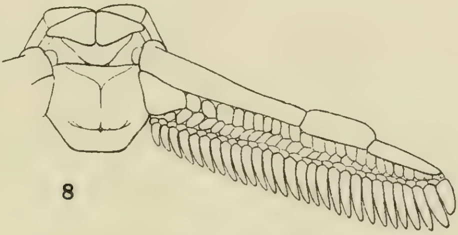

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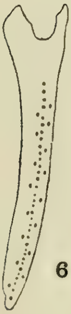

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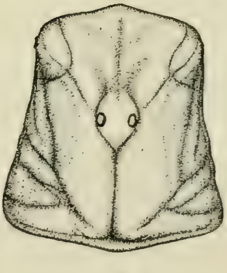

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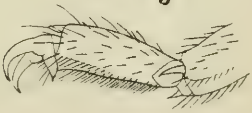

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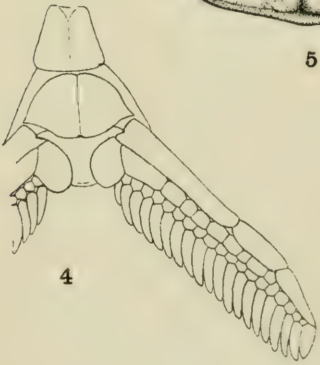

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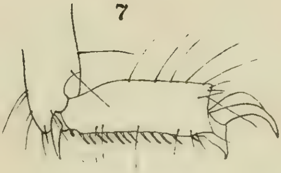

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R. V. C. DEL.

HELIOTYPE CO., BOSTON

PLATE 2.

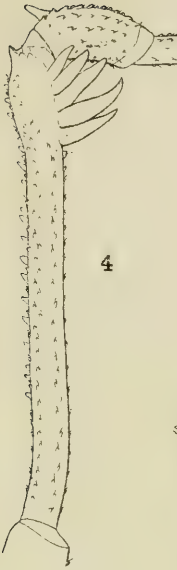
PLATE 2.

Paravanones peruvianus Chamberlin.

Fig. 1. Right mandible, ectal view.
Fig. 2. Right pedipalp, ectal view.
Fig. 3. Anterior portion of carapace from above and a little to the left.
Fig. 4. Femur and adjoining parts of leg IV, the proximal portion in dorsal view, the distal portion in more dorsoectal view.
Fig. 5. Trochanter IV (left), ventral view.
Fig. 6. Showing process of coxa IV, dorsal view.

Gonoleptes enoplus Chamberlin.

Fig. 7. Dorsal view.
Fig. 8. Mandible, ectal view.



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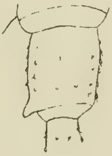

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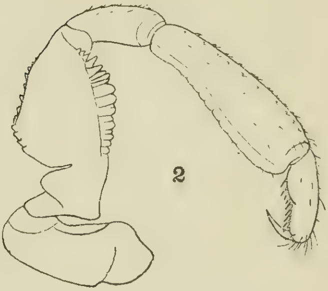

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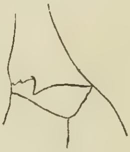

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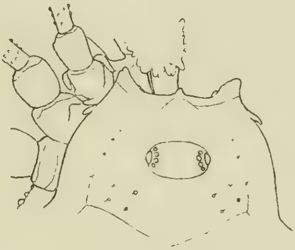

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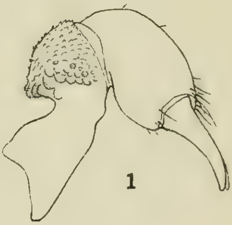

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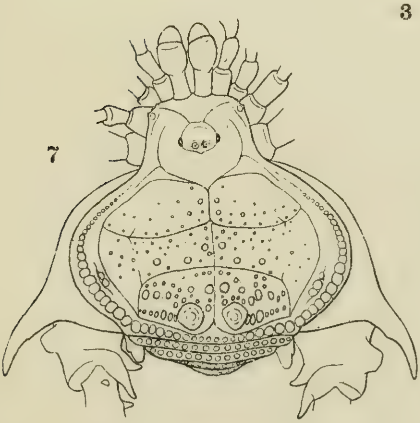

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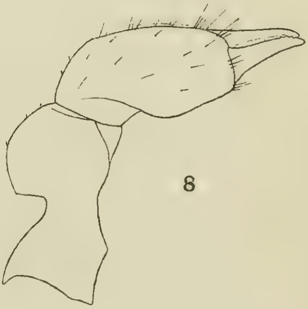

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R V. C., DEL.

HELIOTYPE CO., BOSTON

PLATE 3.

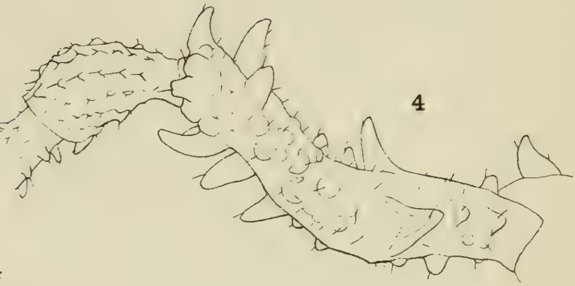
PLATE 3.

Gonoleptes enoplus Chamberlin.

Fig. 1. Coxa and trochanter of left pedipalp, ectal view.
Fig. 2. Left pedipalp, excepting proximal joints, ectal view.
Fig. 3. Leg III, distal portion, anterior view.
Fig. 4. Right leg IV, dorsoectal view.
Fig. 5. Coxal spur of leg IV, lateral view.

Gonoleptes scotius Chamberlin.

Fig. 6. Dorsal view.
Fig. 7. Mandible, ectal view.
Fig. 8. Left leg III, anterior view.



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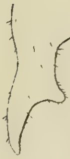

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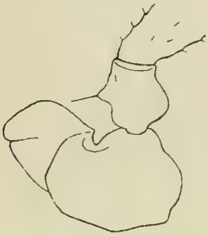

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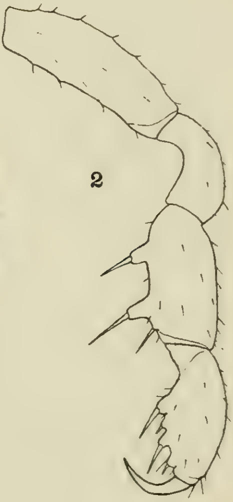

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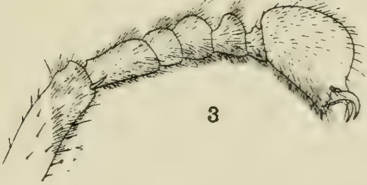

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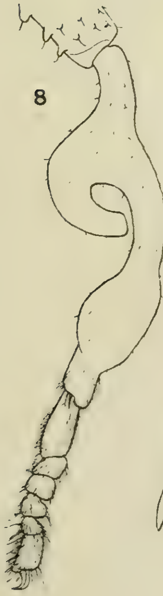

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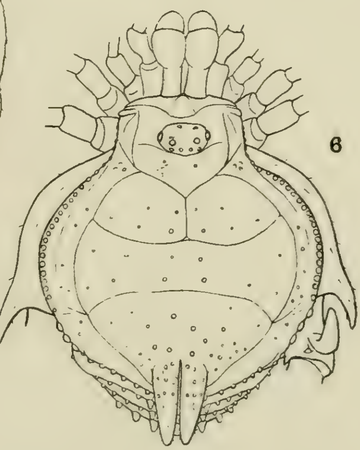

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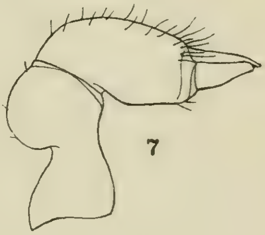

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PLATE 4.

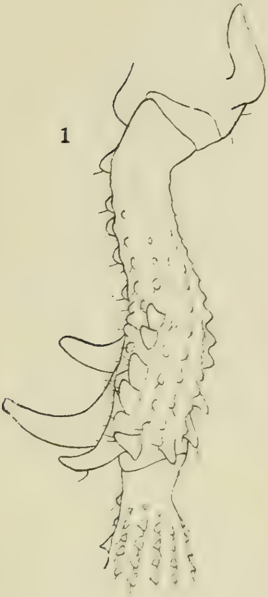
PLATE 4.

Gonoleptes scotius Chamberlin.

Fig. 1. Left leg IV, subdorsal view.
Fig. 2. Right pedipalp, ectal view.

Gonoleptes huadquinae Chamberlin.

Fig. 3. Mandible, ectal view.
Fig. 4. Right pedipalp, ectal view (Type).
Fig. 5. Right pedipalp, ectal view (Paratype).
Fig. 6. Caudal processes of carapace, anterodorsal view (Paratype).
Fig. 7. Left process, lateral view.
Fig. 8. Left leg IV, dorsoectal view.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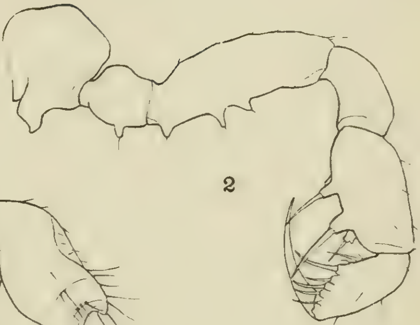
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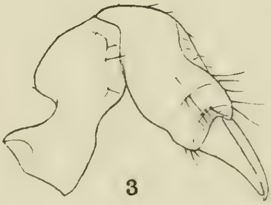
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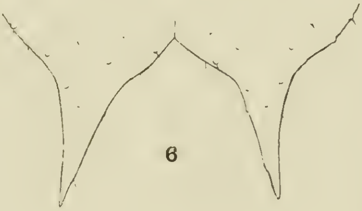
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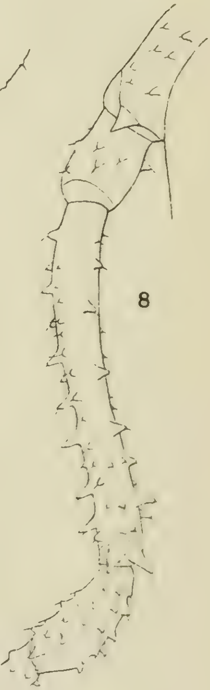
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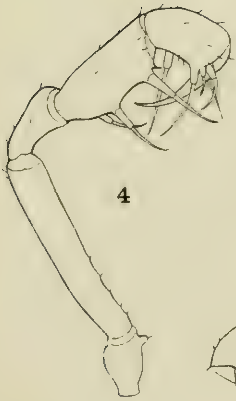
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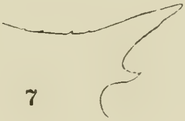
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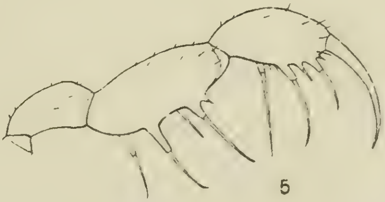
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HELIOTYPE CO., BOSTON

PLATE 5.

Pachylus orinus Chamberlin.

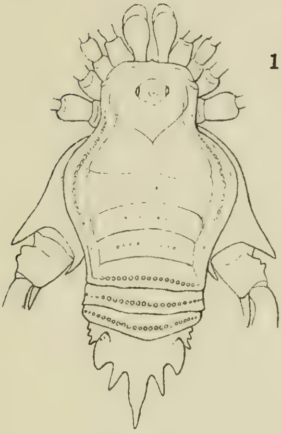
Fig. 1. Dorsal view.
Fig. 2. Right mandible, ectal view.
Fig. 3. Right pedipalp, ectal view.

Liopagus simplex Chamberlin.

Fig. 4. Eye-tubercle, caudal view.
Fig. 5. Eye-tubercle, lateral view.
Fig. 6. Right mandible, ectal view.
Fig. 7. Right pedipalp, mesal view.
Fig. 8. Part of left pedipalp, dorsal view.

Liobunum monticola Chamberlin

Fig. 9. Left pedipalp, ectal view.



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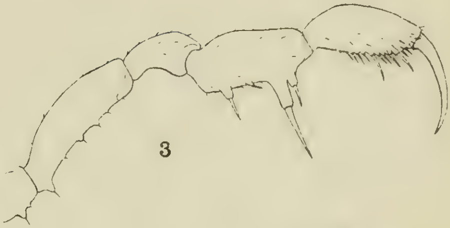

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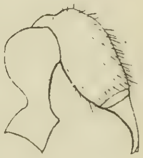

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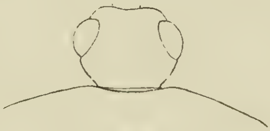

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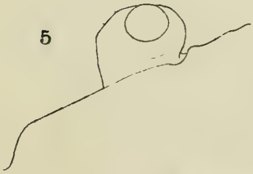

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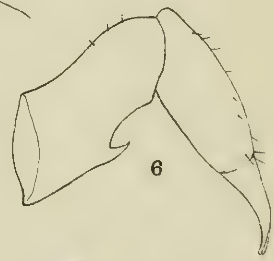

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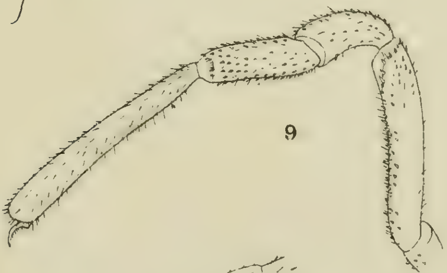

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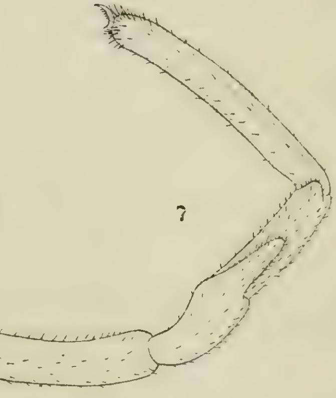

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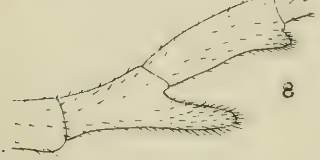

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HELIOTYPE CO., BOSTON

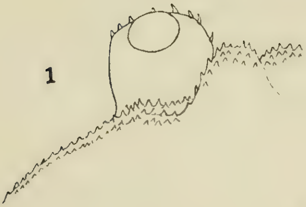
PLATE 6.

Liobunum monticola Chamberlin.

Fig. 1. Lateral view of eye-tubercle.
Fig. 2. Left mandible, mesal view.
Fig. 3. Left mandible, ectal view.

Hemirrhagus peruvianus Chamberlin.

Fig. 4. Eyes, dorsal view.
Fig. 5. Tarsal scale of usual type.
Fig. 6. Tarsal scale of a second type.
Fig. 7. Tibial spurs, right leg I of male.
Fig. 8. Claw of leg IV.
Fig. 9. Lock of tarsometatarsal joint (tarsus above).
Fig. 10. Palpal organ of male, left ectal view.



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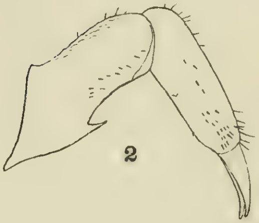

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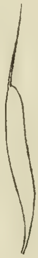

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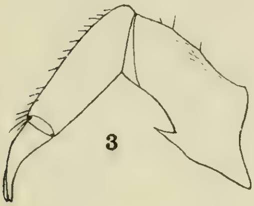

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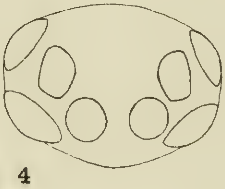

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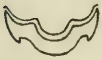

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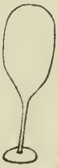

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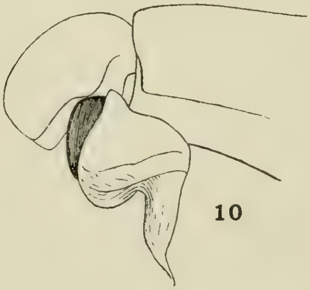

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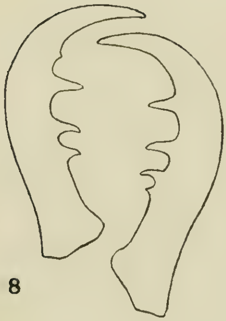

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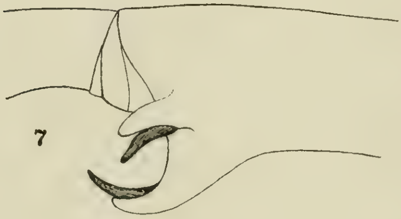

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HELIOTYPE CO., BOSTON

PLATE 7.

PLATE 7.

Hemirrhagus peruvianus Chamberlin.

Fig. 1. Anterior claw of leg I.
Fig. 2. Posterior claw of leg I.

Hemirrhagus major Chamberlin.

Fig. 3. Eyes (Type, Urubamba).
Fig. 4. Tibial spurs, left leg I of male, mesal view.
Fig. 5. Caudal claw, leg I.
Fig. 6. Claw of leg III, female.
Fig. 7. Claw of leg III, male.
Fig. 8. Right palpal organ of male, ectal view (Type).

Diplura monticolens Chamberlin.

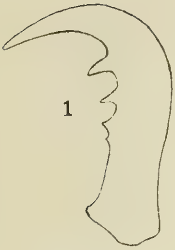
Fig. 9. Eyes, dorsal view.
Fig. 10. Eyes from in front and a little above.

Brachythele keithi Chamberlin.

Fig. 11. Eyes, dorsal view.

Brachythele incursus Chamberlin.

Fig. 12. Eyes, dorsal view (more enlarged than fig. 11).



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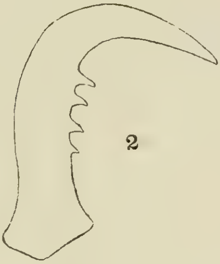

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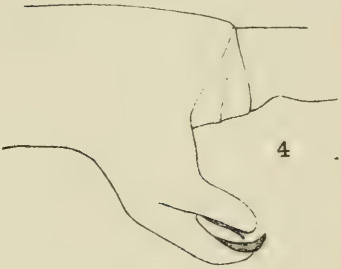

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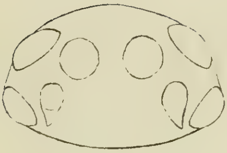

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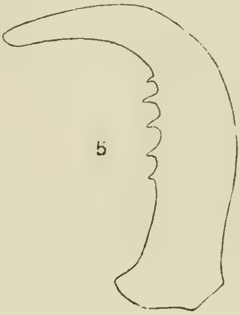

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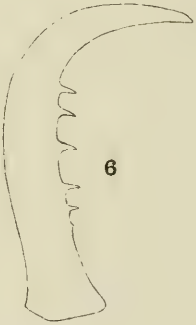

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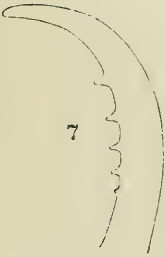

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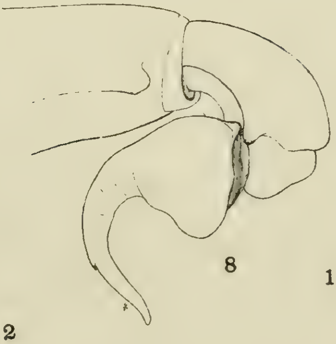

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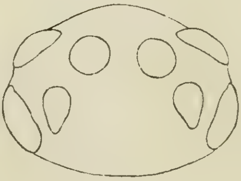

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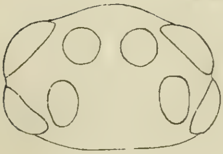

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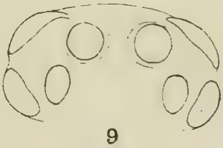

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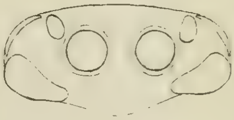

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PLATE 8.

PLATE 8.

Orinomus lamprus Chamberlin.

Fig. 1. Lateral view of body.
Fig. 2. Sternum.
Fig. 3. Epigynum.
Fig. 4. Labium.

Auximus productus Chamberlin.

Fig. 5. Sternum.
Fig. 6. Cribellum.
Fig. 7. Epigynum, caudoventral view.

Dictyna hesperia Chamberlin.

Fig. 8. Epigynum.

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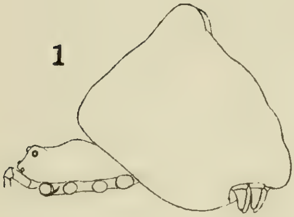

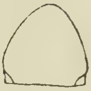
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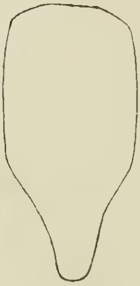

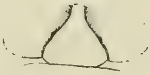
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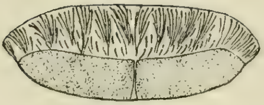
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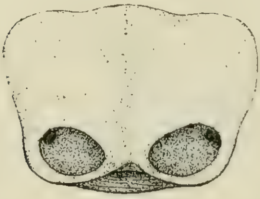

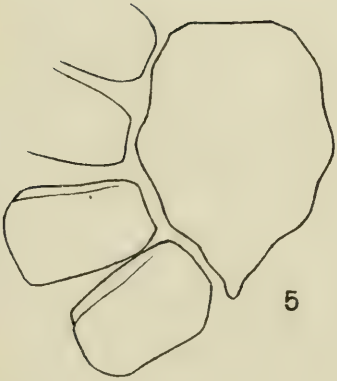
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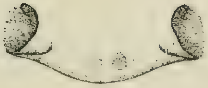

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PLATE 9.

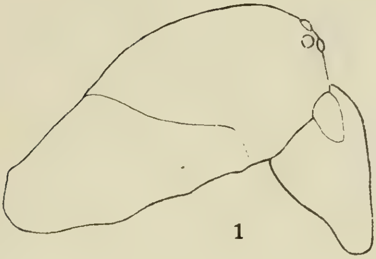
PLATE 9.

Aymarella munda Chamberlin.

Fig. 1. Lateral view of cephalothorax and mandibles.
Fig. 2. Sternum.
Fig. 3. Labium.
Fig. 4. Epigynum.
Fig. 5. Cribellum.

Thomisoides terrosus Nicolet.

Fig. 6. Eyes, dorsal view.
Fig. 7. Mandible, ectal view, showing stridulating plate.
Fig. 8. Labium.
Fig. 9. Distal portion of mandible, ventral view.
Fig. 10. Posterior claw of leg I.



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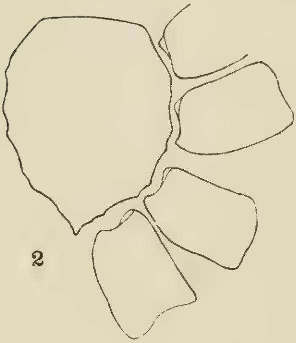

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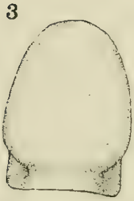

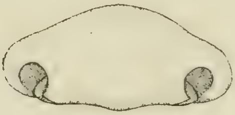

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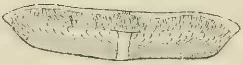

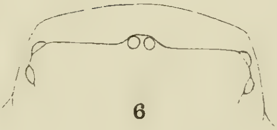

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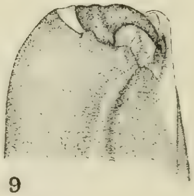

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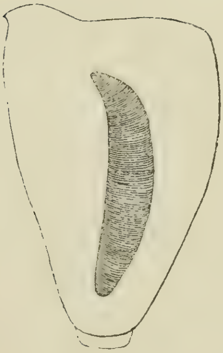

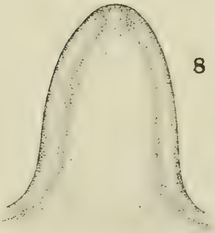

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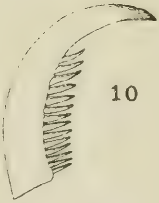

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PLATE 10.

PLATE 10.

Thomisoides terrosus Nicolet.

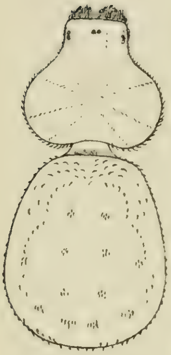
Fig. 1. Dorsal view.
Fig. 2. Base of spine from leg.
Fig. 3. Distal end of bristle from leg.
(Figs. 1 to 3 drawn by Prof. A. Petrunkevitch).

Ariadna hotchkissi Chamberlin.

Fig. 4. Eyes, dorsal view.
Fig. 5. Labium.

Nops bellula Chamberlin.

Fig. 6. Sternum.
Fig. 7. Eyes and anterior part of carapace.
Fig. 8. Labium and left endite.



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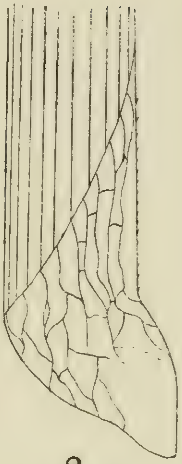

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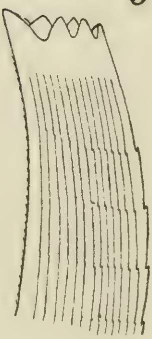

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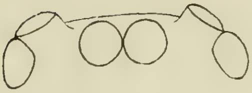

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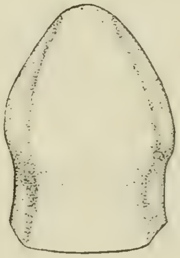

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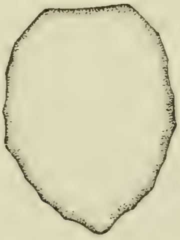

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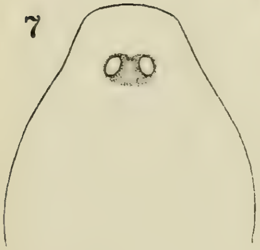

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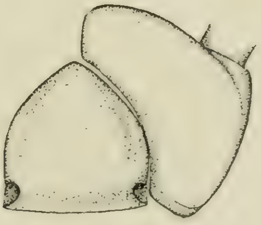

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PLATE 11.

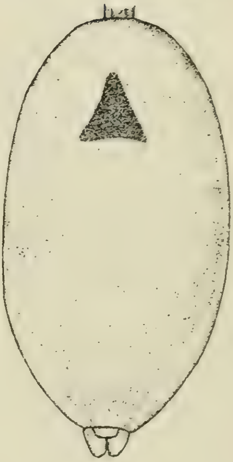
PLATE 11.

Nops bellula Chamberlin.

Fig. 1. Dorsal view of abdomen.
Fig. 2. Distal portion of right leg I, caudal view.
Fig. 3. Mesal and anterior claw of leg I, caudal view.

Drassodes araucanius Chamberlin.

Fig. 4. Eyes, dorsal view.
Fig. 5. Sternum.
Fig. 6. Labium.
Fig. 7. Epigynum.
Fig. 8. Hair of scopula, highly magnified.



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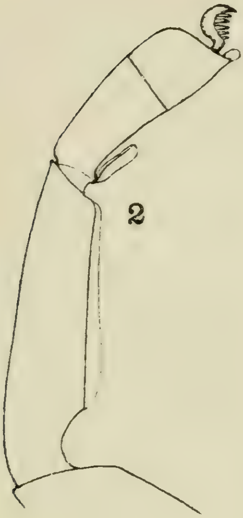

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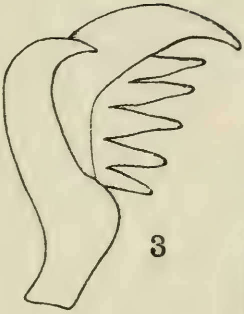

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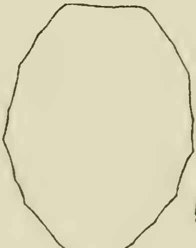

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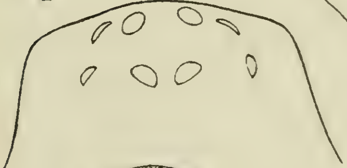

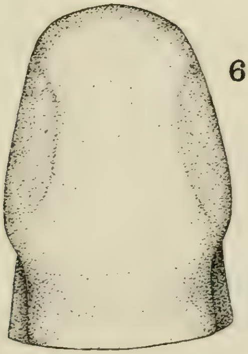

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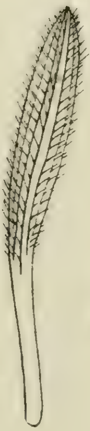

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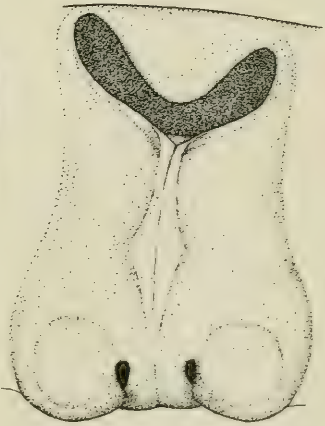

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PLATE 12.

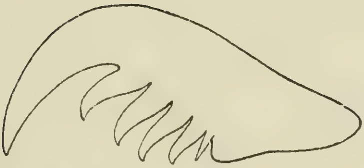
PLATE 12.

Drassodes araucanius Chamberlin.

Fig. 1. Epigynum, possibly lacking one moult of maturity.
Fig. 2. Tarsal claw.

Apodrassus andinus Chamberlin.

Fig. 3. Sternum.
Fig. 4. Hair of fascicula of claw.
Fig. 5. Eyes, dorsal view.
Fig. 6. Labium.
Fig. 7. Claw of leg I.
Fig. 8. Spermathecae.



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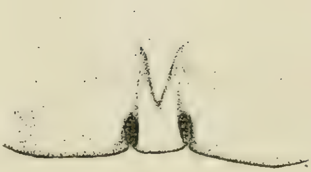

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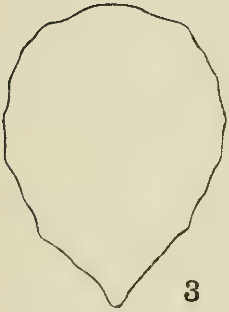

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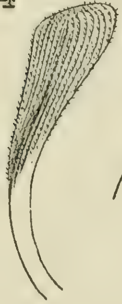

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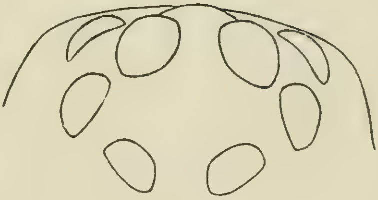

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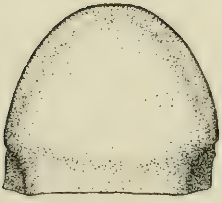

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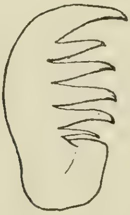

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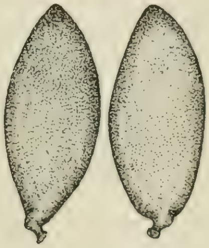

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HELIOTYPE CO., BOSTON

PLATE 13.

PLATE **13**.

Hypsorinus binghamae Chamberlin.

Fig. 1.	Abdomen, lateral view.
Fig. 2.	Eyes, dorsal view.
Fig. 3.	Sternum, labium, etc.
Fig. 4.	Endite, subventral view.
Fig. 5.	Tip of same, sublateral view.
Fig. 6.	Patella, tibia and tarsus of palpus of adult female.
Fig. 7.	Unpaired claw of leg I.
Fig. 8.	Epigynum.
Fig. 9.	Serrated bristle or accessory claw of tarsus I.

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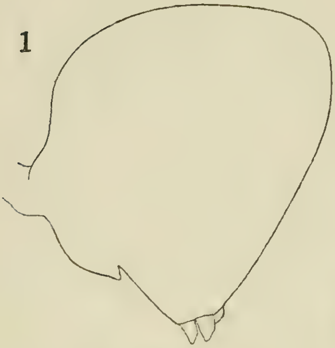

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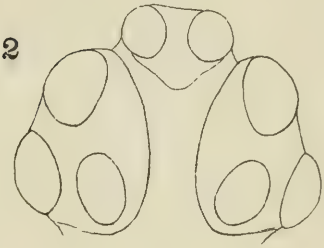

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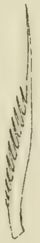

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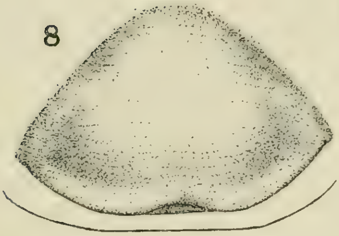

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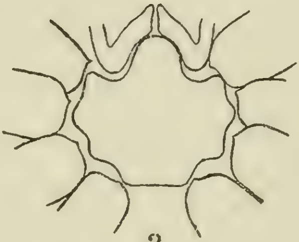

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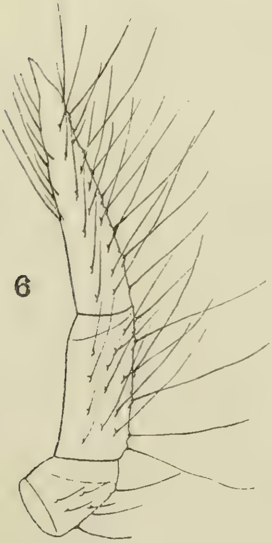

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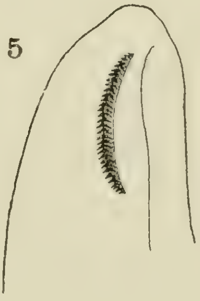

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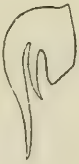

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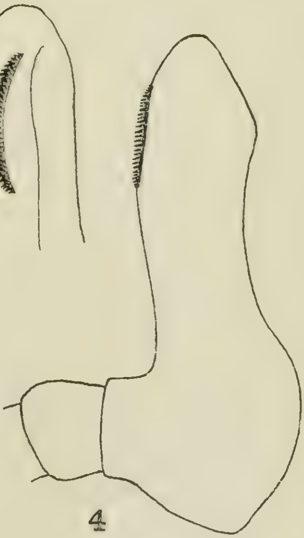

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HELIOTYPE CO., BOSTON

PLATE 14.

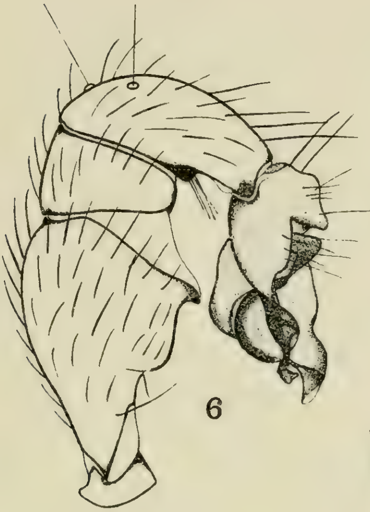
PLATE 14.

Hypsorinus binghamae Chamberlin.

Fig. 1. Feather hair from near claw of leg I.
Fig. 2. Bristle from end of tarsus I above claws.
Fig. 3. End of chelicera of male from above.
Fig. 4. Same of female from above.
Fig. 5. Claw of leg I, female.
Fig. 6. Palpus of male, ectal view.
Fig. 7. Same, from above.

Litoporus aberrans Chamberlin.

Fig. 8. Sternum and labium.
Fig. 9. Abdomen, lateral view.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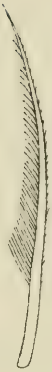
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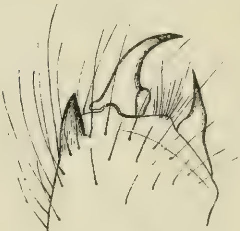
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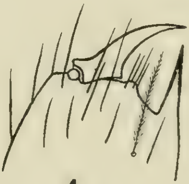
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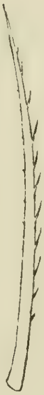
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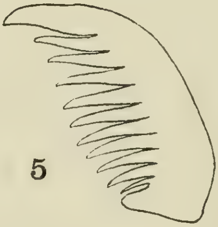
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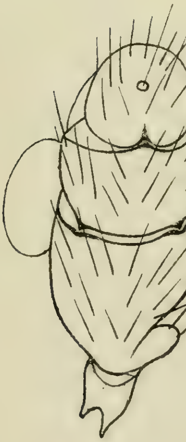
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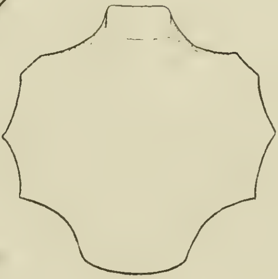
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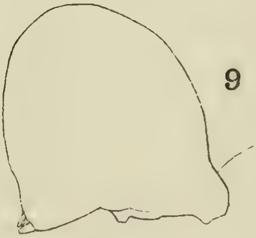
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HELIOTYPE CO., BOSTON

PLATE 15.

PLATE 15.

Litoporus aberrans Chamberlin.

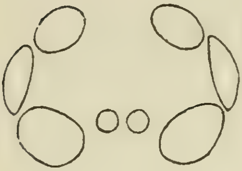
Fig. 1. Eyes from above.
Fig. 2. Right palpus of male, ectal view.
Fig. 3. Palpus of male, anterior view.

Argyrodes lucmae Chamberlin.

Fig. 4. Sternum.
Fig. 5. Abdomen, lateral view.
Fig. 6. Right palpus of male, dorsal view.

Theridion leguiai Chamberlin.

Fig. 7. Sternum.
Fig. 8. Eyes from above.
Fig. 9. Middle and anterior claw, caudal view.
Fig. 10. Epigynum.



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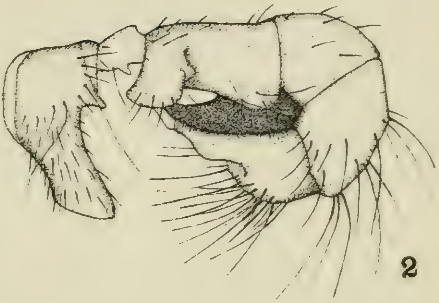

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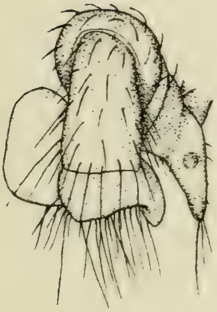

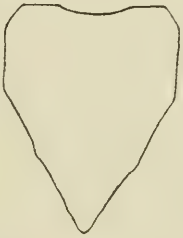

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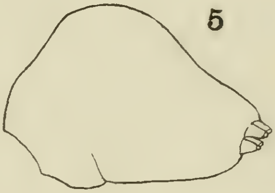

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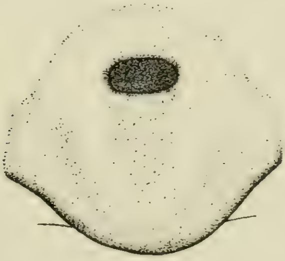

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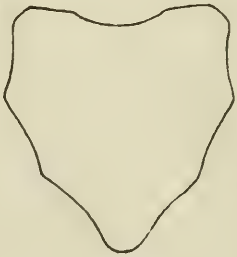

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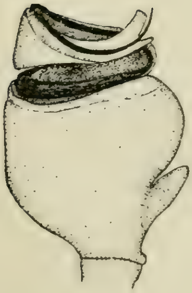

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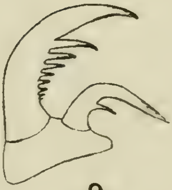

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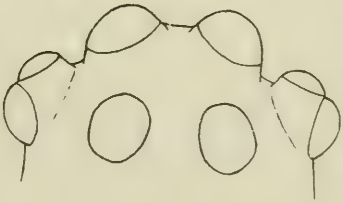

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HELIOTYPE CO., BOSTON

PLATE 16.

PLATE **16**.

Theridion tosum Chamberlin.

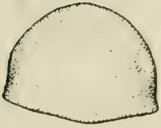
Fig. 1. Labium.
Fig. 2. Sternum.
Fig. 3. Eyes from above.
Fig. 4. Epigynum.

Garricola sanctus Chamberlin.

Fig. 5. Lateral view of body.
Fig. 6. Sternum.
Fig. 7. Epigynum.

Enoplognatha peruviana Chamberlin.

Fig. 8. Sternum.
Fig. 9. Paired claw of leg I.
Fig. 10. Unpaired claw.
Fig. 11. Epigynum.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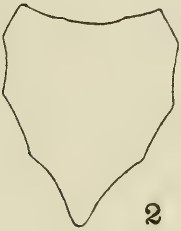
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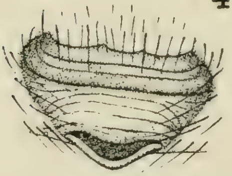
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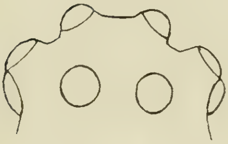
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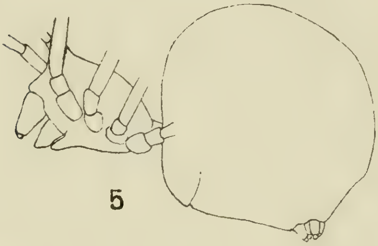
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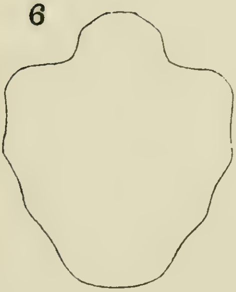
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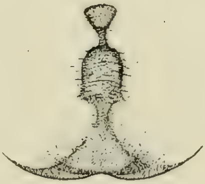
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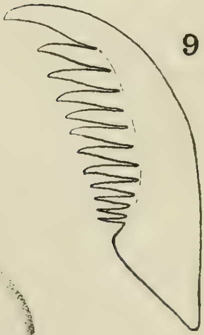
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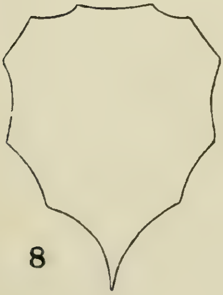
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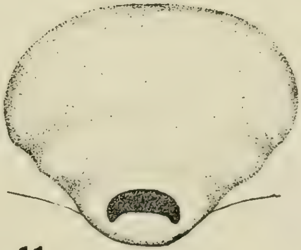
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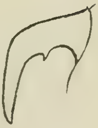
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HELIOTYPE CO., BOSTON

PLATE 17.

PLATE 17.

Enoplognatha peruviana Chamberlin.

Fig. 1. Eyes dorsal view (anterior row above).
Fig. 2. Labium.

Enoplognatha dubia Chamberlin.

Fig. 3. Epigynum.

Erigone niwina Chamberlin.

Fig. 4. Epigynum.

Erigone taibo Chamberlin.

Fig. 5. Epigynum.

Oedothorax melacra Chamberlin.

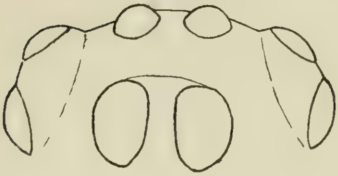
Fig. 6. Palpus.
Fig. 7. Epigynum.

Oedothorax orinus Chamberlin.

Fig. 8. Epigynum.

Tutibo debilipes Chamberlin.

Fig. 9. Epigynum.
Fig. 10. Palpus, distoventral view.



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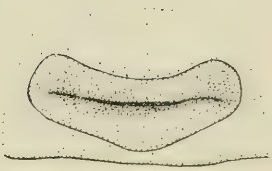

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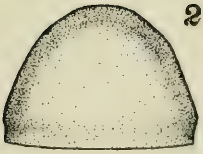

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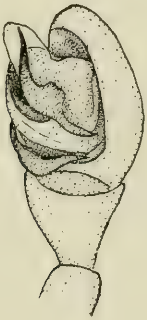

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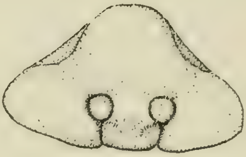

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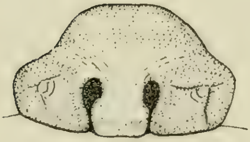

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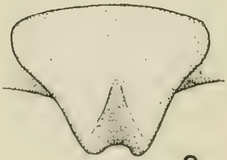

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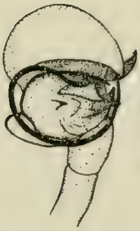

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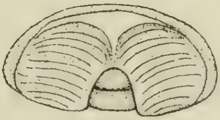

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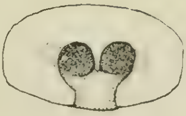

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PLATE 18.

PLATE 18.

Tetragnatha scopus Chamberlin.

Fig. 1. Chelicera from above.

Tetragnatha tincochacae Chamberlin.

Fig. 2. Chelicera of male from above.
Fig. 3. Palpus of male, mesoventral view.

Tetragnatha quechua Chamberlin.

Fig. 4. Chelicera from above.

Meta explorans Chamberlin.

Fig. 5. Epigynum.

Acacesia peruviana Chamberlin.

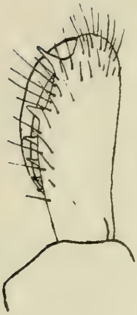
Fig. 6. Epigynum.

Eustala monticola Chamberlin.

Fig. 7. Epigynum.

Aranea duocypha Chamberlin.

Fig. 8. Abdomen, dorsal view.
Fig. 9. Sternum.
Fig. 10. Epigynum.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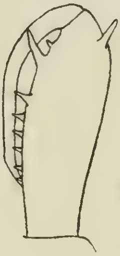
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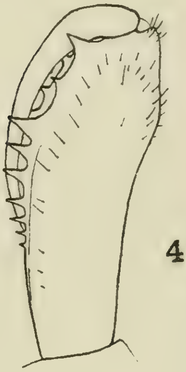
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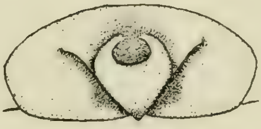
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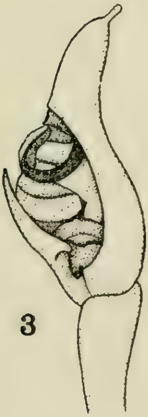
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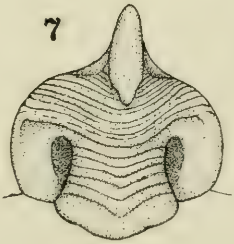
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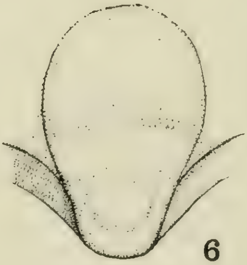
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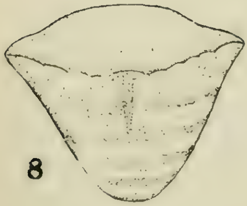
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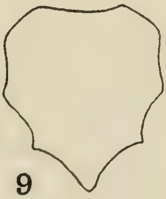
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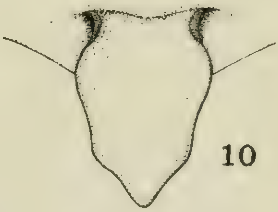
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PLATE 19.

PLATE 19.

Aranea quechuana Chamberlin.

Fig. 1. Palpal organ of male, mesoventral view.

Aranea tigana Chamberlin.

Fig. 2. Palpal organ of male, mesoventral view.

Aranea orina Chamberlin.

Fig. 3. Palpal organ of male, mesoventral view.

Aranea calotypa Chamberlin.

Fig. 4. Palpal organ of male, mesoventral view.

Aranea plesia Chamberlin.

Fig. 5. Epigynum.

Aranea compsa Chamberlin.

Fig. 6. Epigynum.

Aranea sexta Chamberlin.

Fig. 7. Dorsal view of abdomen.

Gea panamensis Chamberlin.

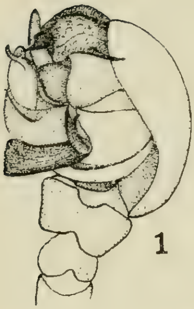
Fig. 8. Left palpal organ of male, mesoventral view.

Scoloderus hybus Chamberlin.

Fig. 9. Epigynum.

Aranea santa Chamberlin.

Fig. 10. Epigynum.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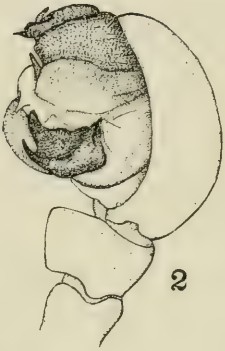
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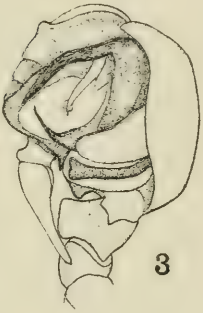
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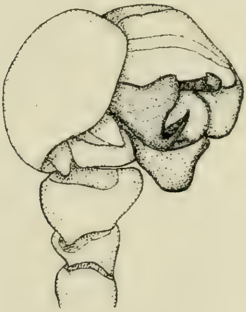
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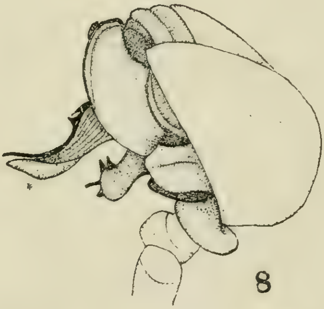
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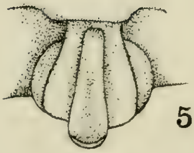
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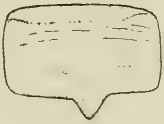
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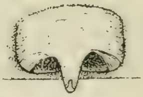
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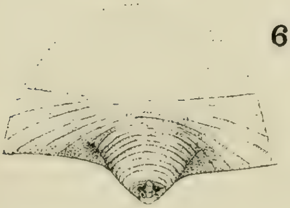
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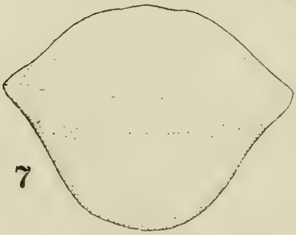
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PLATE 20.

PLATE 20.

Anawixia atopa Chamberlin.

Fig. 1. Eyes from above and a little to the left.
Fig. 2. Abdomen, lateral view.
Fig. 3. Right leg II; anterior view of tibia, etc.

Micrathena cala Chamberlin.

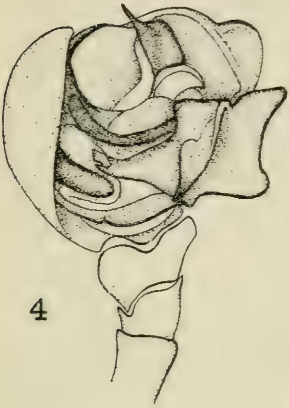
Fig. 5. Dorsal view of abdomen.

Gelanor innominatum Chamberlin.

Fig. 6. Epigynum.

Eusparassus shefteli Chamberlin.

Fig. 7. Sternum.
Fig. 8. Labium.



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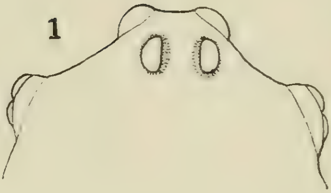

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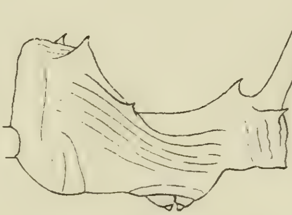

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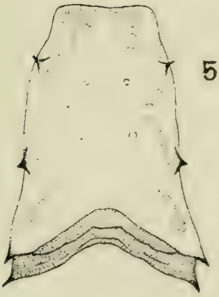

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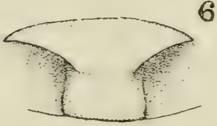

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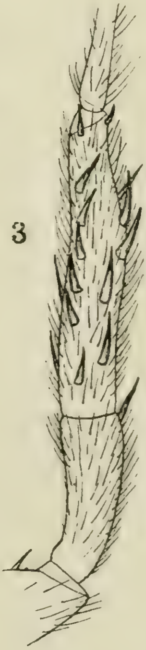

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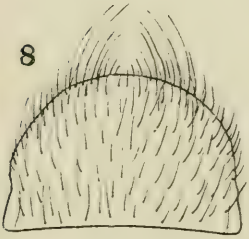

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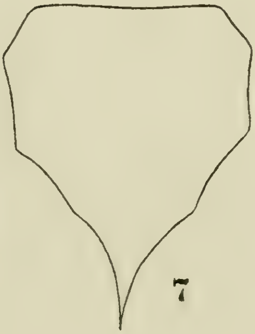

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PLATE 21.

PLATE 21.

Eusparassus shefteli Chamberlin.

Fig. 1. Epigynum.

Horioctenus lycosoides Chamberlin.

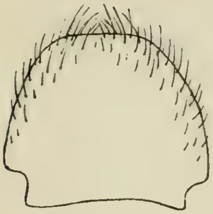
Fig. 2. Labium.
Fig. 3. Epigynum.
Fig. 4. Distal portion of chelicera, ventral view.

Quechuella lampra Chamberlin.

Fig. 5. Labium.
Fig. 6. Sternum.
Fig. 7. Dorsal view of abdomen.
Fig. 8. Eyes from in front and a little above.

Trachelopachys bicolor Chamberlin.

Fig. 9. Labium.
Fig. 10. Epigynum.



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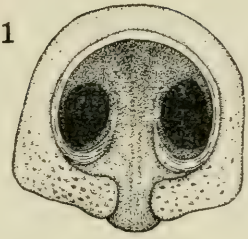

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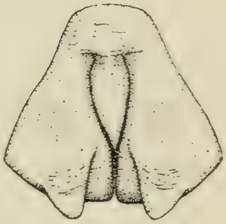

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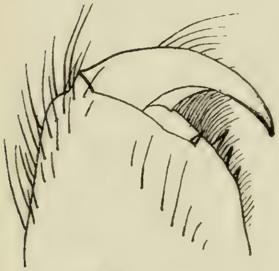

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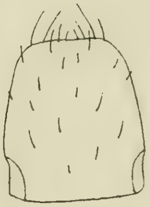

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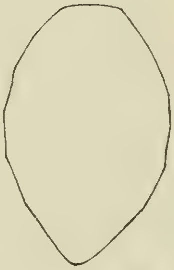

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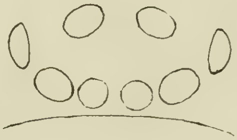

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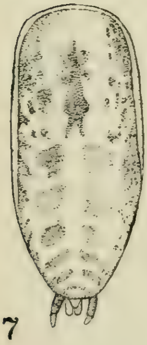

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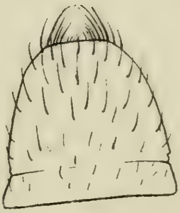

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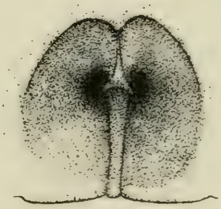

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PLATE 22.

PLATE **22**.

Castaneira quechua Chamberlin.

Fig. 1. Epigynum.

Anyphaena apora Chamberlin.

Fig. 2. Labium.
Fig. 3. Epigynum.

Anyphaena andina Chamberlin.

Fig. 4. Epigynum.

Anyphaena poicila Chamberlin.

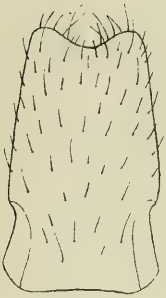
Fig. 5. Dorsal view of abdomen.

Gayenna monticola Chamberlin.

Fig. 6. Epigynum.

Tunabo peruvianus Chamberlin.

Fig. 7. Labium.
Fig. 8. Sternum.
Fig. 9. Distal portion of chelicera, ventral view.



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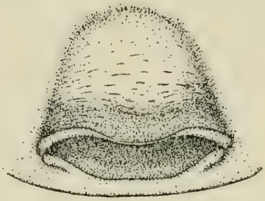

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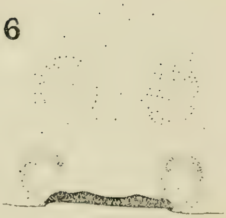

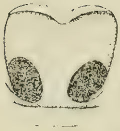

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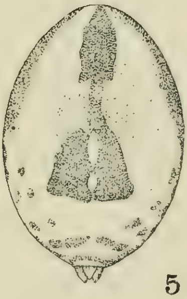

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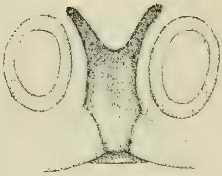

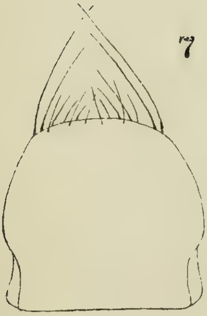

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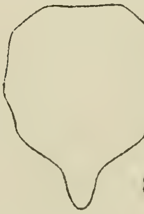

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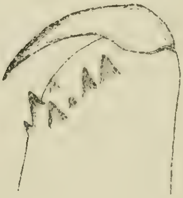

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HELIOTYPE CO., BOSTON

PLATE 23.

PLATE 23.

Trechalea monticola Chamberlin.

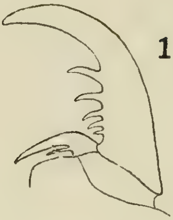
Fig. 1. Paired and single claw.

Porrima harknessi Chamberlin.

Fig. 2. Labium.
Fig. 3. Male palpal organ, ventral view.
Fig. 4. Epigynum.
Fig. 5. Lorum of pedicel.
Fig. 6. Claws.

Arctosa altamontis Chamberlin.

Fig. 7. Epigynum.
Fig. 8. Male palpal organ, ventral view.
Fig. 9. Labium.



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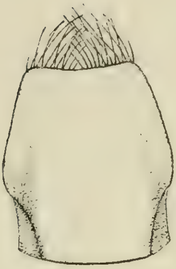

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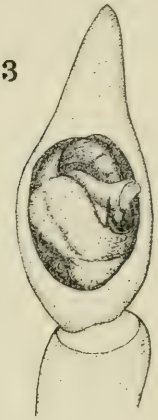

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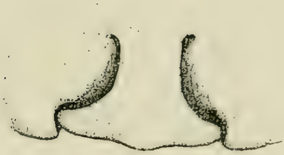

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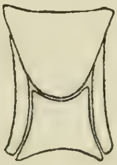

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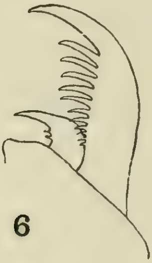

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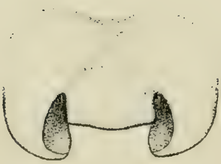

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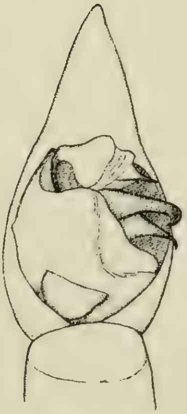

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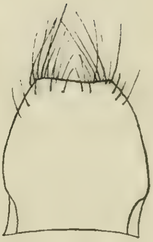

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PLATE 24.

PLATE **24.**

Lycosa orinus Chamberlin.

Fig. 1. Epigynum.

Lycosa andina Chamberlin.

Fig. 2. Epigynum.
Fig. 3. Palpal organ, ventral view.

Lycosa liopus Chamberlin.

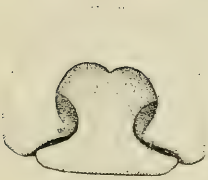
Fig. 4. Epigynum.

Lycosa algina Chamberlin.

Fig. 5. Labium.
Fig. 6. Palpal organ.

Orinocosa aymara Chamberlin.

Fig. 7. Labium.
Fig. 8. Epigynum.



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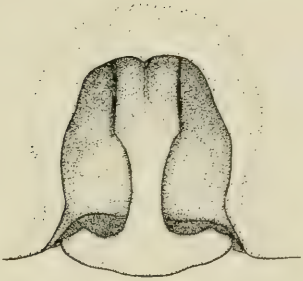

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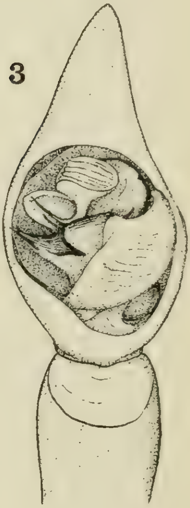

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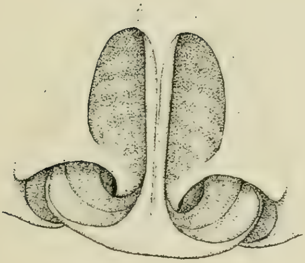

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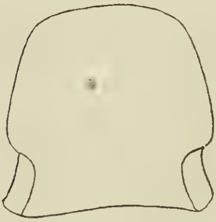

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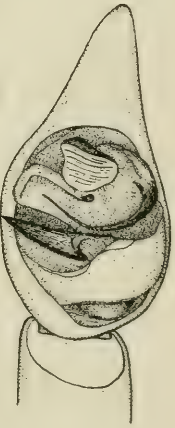

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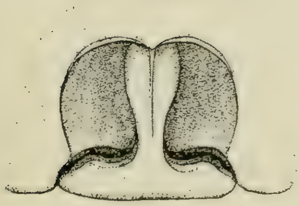

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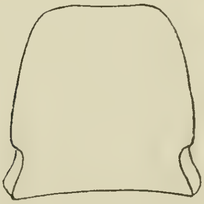


R. V. C., DEL.

HELIOTYPE CO., BOSTON

PLATE 25.

PLATE 25.

Evophrys sima Chamberlin.

Fig. 1. Palpal organ, ventral view.

Wala noda Chamberlin.

Fig. 2. Epigynum.

Phiale huadquinae Chamberlin.

Fig. 3. Palpal organ.

Phiale panamae Chamberlin.

Fig. 4. Palpal organ of male.

Dendryphantes andinus Chamberlin.

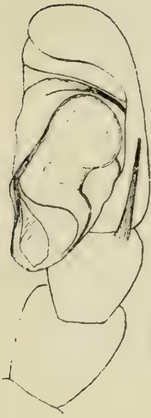
Fig. 5. Palpal organ of male.
Fig. 6. Distal end of chelicera of male, caudal view.

Dendryphantes calus Chamberlin.

Fig. 7. Palpal organ of male, subventral view.
Fig. 8. Distal end of chelicera of male.

Dendryphantes amphibolus Chamberlin.

Fig. 9. Epigynum.



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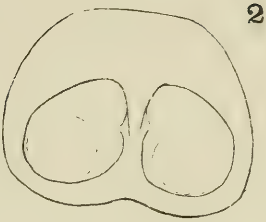

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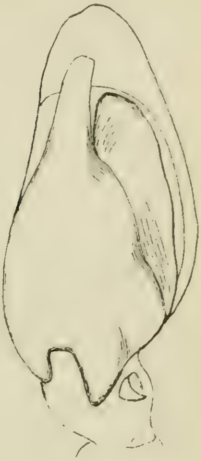

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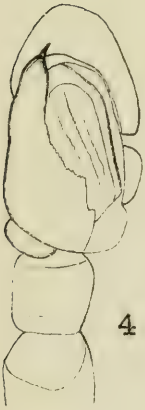

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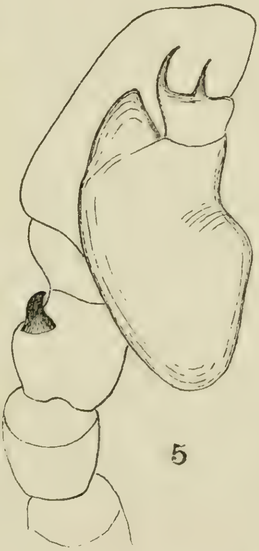

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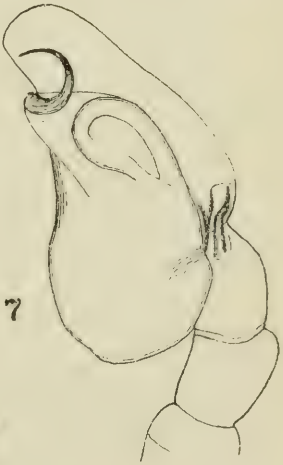

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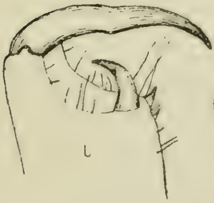

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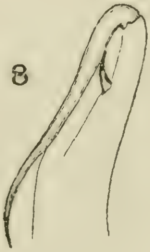

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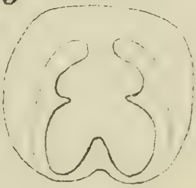

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R. V. C. DEL.

Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. LX. No. 7.

A COLLECTION OF BIRDS FROM THE CAYMAN ISLANDS.

By Outram Bangs.

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March, 1916.

No. 7.— *A Collection of Birds from the Cayman Islands.*

By Outram Bangs.

In the year 1911 the well-known collector, W. W. Brown, Jr., spent the spring and early summer, April to July, in the Caymans. He visited all three islands and made a practically complete collection of the resident, breeding land birds of the group. This beautiful lot of skins, in Brown's inimitable make, fortunately remained intact and was secured for the Museum of Comparative Zoölogy. Below I give an annotated list of the collection which represents only the resident ornis of the islands, being happily free from migrants.

In the Ibis for 1911, (ser. 9, **5**, p. 137–161), Mr. P. R. Lowe published a list of the birds of the Cayman Islands. Lowe's account of the islands and his description of them is so good and complete as to leave nothing more to be said. He also brought up to date all bird collecting that had been done there. I must, however, give my opinion upon the sources whence the bird life peculiar to the Caymans has been derived.

Lowe justly states that on account of the very recent origin of the islands no genus and no very peculiar forms occur there alone. In the main, this is true, but I think for the moment he had forgotten *Mimocichla ravida.* This bird bears no close relationship to any other existing species of the genus. We must, however, bear in mind that Jamaica at present, alone among the Greater Antilles, is without a species of Mimocichla. It is highly probable that a form similar to *M. ravida* once occurred there and that the Cayman bird, now itself on the verge of extinction, was derived from that form.

Coereba sharpei is a species of uncertain origin. The genus Coereba has been in the near past, and perhaps is still, so very plastic that the relationships of the various forms are hard to trace.

Dendroica vitellina (which also occurs in Swan Island) and *D. crawfordi,* quite clearly indicate an instance, rather rare among birds, of a migratory species establishing itself upon islands that lie on the line of passage and becoming differentiated there; for clearly the nearest relation of these two wood-warblers is the migratory North American *Dendroica discolor.*

Three other peculiar forms were, I believe, received directly from the near by mainland. These are the Elaenia which is much more like *E. martinica subpagana*, than it is any of the gray Lesser Antillean forms; the *Vireosylva caymanensis* which is very closely related to *V. magister* of the coast of British Honduras and unlike any West Indian form; and the Vireo, which so far as I can see is identical with *V. crassirostris* the bird inhabiting the Bahamas (which are of similar formation). This species is so much like *V. ochraceus* of the opposite coasts of Central America and so unlike any of the species peculiar to the Greater Antilles,— Cuba, Jamaica, or Porto Rico, that there seems no question of its origin.

The remainder of the Cayman birds have come from either Jamaica or Cuba, in some case being still identical with the parent stock, in others having differentiated into what may be called island species or subspecies according to the degree of change. From Jamaica the Caymans have received *Leptotila collaris* and *Icterus bairdi*. From Cuba the islands have derived the two forms of Amazona peculiar to them, *Colaptes gundlachi*, *Centurus caymanensis*, *Mimocichla coryi*, two forms of Holoquiscalus, *Spindalis salvini*, and *Melopyrrha taylori;* probably also *Tolmarchus caymanensis*, although this species might be descended from either *T. caudifasciatus* of Cuba or *T. jamaicensis* of Jamaica.

From the above which discusses every bird peculiar to the Caymans it will be seen that I am unable to recognize several forms which have been described as species or subspecies peculiar to the islands, and these I comment upon at length in the following list.

At the time of Brown's visit to Little Cayman and Cayman Brac — June and July — the Boobies and Man-o'-War-Birds were not breeding and all he saw during his stay were occasional birds off shore. Besides these and the list of species following he saw and positively identified only two species, namely *Hydranassa tricolor ruficollis* (Gosse) and *Nyctanassa violacea* (Linné).

Brown took nests and eggs of a number of the species; these are preserved in the Museum of Comparative Zoölogy, and I believe some of them have not before been collected. I have marked with an asterisk each species of which he secured the nest and eggs; and with a dagger the species of which the eggs only were taken.

As this paper was going to press, an article on the birds of Grand Cayman appeared in the Ibis, January 1916, p. 17–35, by T. M. Savage English. Mr. English apparently collected no specimens, but based all his identifications on living birds observed afield. During his three years' residence in the island he was able to add twelve species to Lowe's list. A few of these are merely migrants. Four others I had already included in the following account of Brown's collection, and I let my words stand as first written.

It would be of interest to know the bird that Mr. English found breeding in Grand Cayman and called *Chordeiles virginianus,* distinguishing it from *Chordeiles minor* by its larger size. On geographic grounds it certainly could not have been *Chordeiles virginianus virginianus* (Gmelin).

ARDEIDAE.

*BUTORIDES VIRESCENS BRUNESCENS (Lemb.).

Two specimens, an adult ♂ and an immature ♀, Grand Cayman, May.

These are similar to specimens from Jamaica and Cuba. I have already (Auk, Oct. 1915, **32**, p. 481–484) given my reasons for using the name *brunescens* for the Green Heron of the Greater Antilles. Whether or not that form can be maintained as distinct from *B. v. maculatus* (Bodd.) of Martinique remains, I think, to be proved. Oberholser has probably subdivided the Green Heron too much, and he had but three specimens from Martinique when he wrote his Revision of the subspecies of the Green Heron (Proc. U. S. N. M., 1912, **42**, p. 529–577).

RALLIDAE.

*GALLINULA CHLOROPUS CACHINNANS Bangs.

Brown found the Gallinule breeding in abundance in the many marshy ponds in Grand Cayman in April and May, and took several sets of eggs, but made up no skins.

LARIDAE.

†STERNA ANTILLARUM (Lesson).

One adult ♂, Little Cayman, July 26. Brown found the Least Tern breeding in abundance.

CHARADRIIDAE.

CHARADRIUS WILSONIUS Ord.

Brown noted Wilson's Plover on several occasions on the beaches, where he thought it was breeding. He took no specimens. I include it in this list on Brown's identification in spite of the lack of specimens, in order to correct a rather curious error in Lowe's list where under *Aegialitis semipalmata* Lowe says, "This bird is resident in Jamaica and breeds there. Whether it does so in the Caymans I am unaware. I have included it among the residents." No mention is made of Wilson's Plover, and it seems certain that Lowe in some way confused that species with the Arctic-breeding Semipalmated Plover.

† HYPSIBATES MEXICANUS (Müll.).

The Black-necked Stilt was breeding in numbers in the mangroves in Grand Cayman in May. Brown took several sets of eggs, but did not shoot any birds.

COLUMBIDAE.

COLUMBA LEUCOCEPHALA Linné.

Three specimens, two males and a female, all adult, Grand Cayman and Cayman Brac, May and June.

† ZENAIDA ZENAIDA ZENAIDA (Bp.).

Zenaida spadicea Cory, Auk, 1886, **3**, p. 498, Grand Cayman.

Zenaida richardsoni Cory, Auk, 1887, **4**, p. 7, Little Cayman.

Thirteen specimens, both sexes, all adult, Grand Cayman, Little Cayman, and Cayman Brac, May, June, and July.

I can find no difference in specimens from the various islands of the Cayman group, and after a most careful comparison, with adequate material, am unable to distinguish in any way Cayman specimens, which appear to me to be quite like examples from the Bahamas, Cuba, and Jamaica, in the same condition of plumage.

Judging from Cory's name and description I fancy he took the Grand Cayman Pea Dove to be darker than true *zenaida*. This may have been because he compared Grand Cayman specimens killed when in worn summer plumage, with skins from elsewhere in autumn or winter dress, there being quite a change with season in

Z. zenaida. This is wholly due, I think, to wear and the loss of the bloom or sheen characteristic of the fresh plumage.

* CHAEMEPELIA PASSERINA INSULARIS (Ridg.).

Eleven specimens, all adult males, Grand Cayman, Little Cayman, and Cayman Brac. April, May, and June.

There is no difference in skins from the three islands. On comparing this series with an enormous number of Cuban birds, I could find no differences at all, in color, color of the bill, size, or anything else. I therefore sent the series to W. E. C. Todd, as the latest authority on this group of birds, and asked him for an opinion that I might quote in print. He replied that he was now fully prepared to say that the Cayman and Cuban forms are identical. *Chaemepelia passerina aflavida* (Palmer and Riley) therefore becomes a synonym of *P. p. insularis* (Ridg.). The Jamaican form, though very close still appears to be recognizable.

† LEPTOTILA JAMAICENSIS COLLARIS (Cory).

Five specimens, both sexes, all adult, Grand Cayman, May and June.

Brown considers this Dove to be the rarest of all the peculiar Grand Cayman birds. The five specimens he took were the result of days spent hunting especially for it in its favorite haunts.

I can detect no differences whatever in color in comparing these Grand Cayman skins with our twelve specimens of true *L. jamaicensis* (Linné) from Jamaica. The Cayman examples appear to have less white at the tips of the three outer rectrices. This may be partly, perhaps wholly, due to their tail feathers being more worn down at the ends. The Cayman specimens also average slightly smaller than Jamaican ones, as the following measurements show, but the difference is so trifling that a larger amount of material might actually turn it the other way, and I doubt much if the form can be maintained.

GRAND CAYMAN.

No.	*Sex*	*Wing*	*Tail*	*Tarsus*	*Exposed Culmen*
68334	♂	148	103	29	16
68335	♂	146	90	31	16
68338	♂	153	105	31.5	15.5
68336	♀	142	95	28	15.5
68337	♀	144	102	27.5	16

JAMAICA.

No.	*Sex*	*Wing*	*Tail*	*Tarsus*	*Exposed Culmen*
37732	♂	159	111	31.5	16.5
37733	♂	161	112	31	17
37734	♂	157	109	29	16
54089	♂	154	109	32	16
3695	♂	153	108	30	16.5
3696	♂	158	108	33	17
37735	♀	153	107	29	16
37736	♀	151	105	29.5	16.5
37737	♀	153	100	29	16
41841	♀	159	106	32	16.5
54088	♀	151	99	28.5	16
71554	♀	151	96	28.5	16

PSITTACIDAE.

† AMAZONA LEUCOCEPHALA CAYMANENSIS (Cory).

Ten specimens, both sexes, all adult, Grand Cayman, May and June.

This well-marked form is peculiar to Grand Cayman. I agree with Todd (Annals Carnegie mus., 1911, **7**, p. 418) that its relationship to true *leucocephala* of Cuba, which is close, is best expressed by the use of trinomials.

Brown noted that the skin of the orbital region, varied from white to flesh-color. He took a set of four eggs together with the female parent on May 12.

AMAZONA LEUCOCEPHALA HESTERNA, subsp. nov.

Ten specimens, both sexes, all adult, Little Cayman and Cayman Brac, June and July.

Type, adult ♂, M. C. Z. 68313, Cayman Brac, July 15, 1911, W. W. Brown, Jr.

Characters. Similar to true *A. leucocephala* (Linné) of Cuba, but smaller. Paler green, lime-green to mignonette-green (in the Cuban bird about Kronberg's green); under tail coverts and under surface of tail (beyond the red base) paler and more yellowish; red belly patch always large, more sharply contrasted and brighter red without lavender shimmer — bright hydranger-red — (dark vinaceous, almost always, more or less touched with lavender in true *leucocephala*); outer surface of closed wing paler and duller blue, more greenish,— much more as in *A. l. caymanensis;* shorter upper tail coverts, sometimes also longer upper tail coverts and lower rump feathers, more or less extensively edged and tipped with red (Cuban examples of true *A. leucocephala* seldom show such red markings, and when they do only to a very slight extent). Brown noted the iris as brown and the orbital skin as white to grayish white, the tarsus as yellow.

Measurements.

CAYMAN BRAC.

No.	*Sex*	*Wing*	*Tail*	*Tarsus*	*Culmen from Cere*
68312	♂	132	110	21	27
68313	♂	134	109	23	27
68315	♂	133	113	21	27
68316	♂	129	103	22	25
68309	♀	132	109	22	26
68310	♀	128	111	23	25
68311	♀	126	102	21	24
68314	♀	129	107	21	23
68317	♀	134	106	21	25

LITTLE CAYMAN.

68308	♀	131	111	22	25

Remarks. Brown found this Parrot to be not uncommon though of rather local distribution in Cayman Brac. He also took one specimen in Little Cayman on July 25.

CUCULIDAE.

CROTOPHAGA ANI Linné.

Three specimens, both sexes, all adult, Grand Cayman and Little Cayman, May and July.

* COCCYZUS MINOR NESIOTES (Cab. and Heine).

Eleven specimens, both sexes, all adult, Grand Cayman, Little Cayman, and Cayman Brac, May, June, and July.

These specimens agree with Jamaican skins in size and proportions and are a little larger than the Bahaman form *C. m. maynardi* Ridg. In the color of the under parts this series shows a wide range of individual variation. The darkest ones are exactly like the paler specimens from Jamaica and the palest ones like the darker examples of *maynardi.* Thus as a whole the series averages a little paler below than the average of a long series of *nesiotes* from Jamaica. All, however, were taken later in the season, than any skin we have from Jamaica and are without doubt somewhat faded out.

HYBRIDIDAE.

HYBRIS PERLATA FURCATA (Temm.).

One adult ♀, Cayman Brac, June 27. This is a very pale and gray individual, rather different from ordinary specimens from Jamaica or Cuba. In a long series from Jamaica, however, we have one skin that agrees with it exactly.

CAPRIMULGIDAE.

CHORDEILES VIRGINIANUS MINOR (Cab.).

One adult ♂, Little Cayman, July 17.

Brown made no note on the abundance of the Little Nighthawk in the Caymans, which I believe has not before been recorded from the islands. It is possible that this individual may have been a migrant from Cuba, where the bird breeds abundantly, but apparently does not winter.

PICIDAE.

† COLAPTES CHRYSOCAULOSUS GUNDLACHI Cory.

Thirteen specimens, both sexes, all adult, Grand Cayman, April, May, and June.

This series shows in a marked degree the two characters pointed out by Ridgway in his Birds of North and Middle America — smaller size and smaller and narrower black malar patch in the males — which distinguish it from the Cuban form. It is confined to Grand Cayman.

† CENTURUS CAYMANENSIS Cory.

Nine specimens, both sexes, all adult, Grand Cayman, April, May, and June.

This strongly characterized island species, is one of the commoner birds of Grand Cayman to which island it is confined.

TYRANNIDAE.

TYRANNUS DOMINICENSIS DOMINICENSIS (Gmel.).

Four specimens, both sexes, all adult, Grand Cayman and Cayman Brac, April and June.

TOLMARCHUS CAYMANENSIS (Nicoll).

Twenty specimens, both sexes, young and adult, Grand Cayman, Little Cayman, and Cayman Brac, April, May, June, and July.

This is a well-marked form peculiar to the Caymans, where, I believe, it does not differ either in color or size in the three islands of the group. In fresh spring plumage (April specimens from Grand Cayman) the back is distinctly olivaceous, as compared with the gray back in the Cuban form, *T. caudifasciatus* (D'Orbigny), in similar plumage. In birds killed by May 25 and from then on through the summer, the color of the back, by fading and wear, has changed to a dirty grayish, quite the same as in Cuban skins in the same condition of feather. In this plumage the Cayman bird can only be recognized by its much duller, browner head, less contrasted with the gray of the back — the head of the Cuban bird in worn plumage being very black and sharply contrasted against the color of the back. The Cayman bird also has a longer and more slender bill, this character being well marked as an average one, but unfortunately failing in the case of certain individuals. All the adults from Little Cayman and Cayman Brac, except one, are in the worn and faded midsummer plumage just referred to; the one exception is M. C. Z. 68248 Cayman Brac, June 29, which, though taken on a date earlier than some others that had not changed, has almost completed the postnuptial moult and has again an olivaceous back. The color of the back in this skin is quite the same as in the April specimens from Grand Cayman, while the more faded Grand Cayman individuals killed May 25 are like the ones from Little Cayman and Cayman Brac taken in June and July. Brown took fully fledged young from July 10 to July 28. The wing in the adults in this series ranges, in Grand Cayman skins, from 103–107; in skins from Cayman Brac, 97–103; in the only adult from Little Cayman (a ♂) it is 108. The Cayman Brac specimens have the tips of the primaries a little more worn down than the Grand Cayman ones.

MYIARCHUS SAGRAE SAGRAE (Gundlach).

Myiarchus denigratus Cory, Auk, Oct. 1886, **3**, p. 500, 502, Grand Cayman.

Ten specimens, both sexes, all adult, Grand Cayman, April and May. Apparently this bird is found in Grand Cayman only of the Caymans. The specimens in the present series are indistinguishable in any way from Cuban skins.

* ELAENIA MARTINICA CAYMANENSIS Berlepsch.

Elaenia martinica complexa Berlepsch, Proc. 4th International ornith. congress, 1905, p. 395, Cayman Brac.

Twenty-six specimens, both sexes, all adult, Grand Cayman, Little Cayman, and Cayman Brac, April, May, June, and July.

Specimens in exactly similar plumage from the three islands of the Cayman group are absolutely alike, and no subdivision can be made. I am sure Berlepsch was deceived by the artificial discoloration of Maynard's Cayman Brac skins, upon examples of which he based his *E. m. complexa.* Two such skins are now before me and I do not wonder at such a mistake being made.

The Cayman Elaenia fades and bleaches out late in summer, losing all its colors. Two skins collected in Grand Cayman in August, 1886, by W. B. Richardson, have lost all traces of the colors and markings of the form when in fresh plumage. The April specimens in the present series from Grand Cayman are in beautiful fresh unfaded plumage. Some of the late July skins from Cayman Brac have nearly completed the postnuptial moult and are indistinguishable from these. Others taken at the same time had not commenced to moult, and are nearly as faded out as the August examples just referred to.

The Cayman bird appears an excellent form, but I cannot agree with some other ornithologists that its nearest relation is *E. m. riisii* Scl. of St. Thomas. Nor do I think it very closely related to any of the distinctly gray Lesser Antillean forms. It seems obviously much more like *E. m. subpagana* Scl. and Salv. of the near by mainland, with which it exactly agrees in size and markings and in color except in being *paler* throughout. In good plumage the belly is uniformly yellow, the chest dull yellowish gray, the throat grayish white, and the upper parts olive. All these colors, however, are much paler than in the continental bird.

I think that this bird was derived not through any of the Lesser Antillean forms, which on zoögeographical grounds would seem out of reason, but like *Vireosylva caymanensis* and probably *Vireo crassirostris* direct from the form occupying the adjacent mainland.

MIMIDAE.

* MIMUS POLYGLOTTOS ORPHEUS (Linné).

One adult ♂, Grand Cayman, May 14.

The Jamaican Mockingbird is abundant in Grand Cayman, but apparently is wanting in the two smaller islands.

TURDIDAE.

MIMOCICHLA RAVIDA Cory.

Thirteen specimens, both sexes, all adult. Grand Cayman, April, May, and June.

The Grand Cayman Thrush belongs in a group of the genus Mimocichla by itself, and of all the birds peculiar to the Caymans is the only one that is very distinct, having no representative elsewhere. In view of the recent origin of the ornis of the Caymans, it is probable that there was somewhere, possibly in Jamaica, where no member of the genus now occurs, a related form which has disappeared.

The Thrush is now extremely rare and local in Grand Cayman. Brown covered the whole island and found it only in two remote patches of woodland. Each of these tracts of rather heavier forest than is usual in the island now-a-days was inhabited by a few pairs of thrushes, which Brown believes to be the entire population of the island. In each of these woods Brown was careful to leave birds enough to perpetuate the species, if it is not gradually becoming extinct from some natural cause, as seems to be the case.

Brown noted the colors of the soft parts to be as follows: — "Iris, brown; tarsus, bill, and bare skin of orbital region, coral red."

MIMOCICHLA RUBRIPES CORYI Sharpe.

Twenty-three specimens, both sexes, all adult, Cayman Brac, June and July.

Unlike its cousin of the larger island, the Cayman Brac Thrush is an extremely abundant bird. It is a very well-marked form, with a large light-colored bill.

VIREONIDAE.

VIREOSYLVA MAGISTER CAYMANENSIS (Cory).

Twelve specimens, both sexes, all adult, Grand Cayman, April and May.

Brown found this Vireo in the mangroves in Grand Cayman, where it was not uncommon. It has been recorded from both Little Cayman and Cayman Brac by Cory, but Brown did not find it in either of the smaller islands, where its place seemed to be wholly taken by *V. calidris barbatula.*

The Grand Cayman Vireo is very closely related to true *V. magister* Lawr. of the coast of British Honduras, from which it differs only by its paler coloration.

VIREOSYLVA CALIDRIS BARBATULA (Cab.).

Fifteen specimens, both sexes, all adult, Little Cayman and Cayman Brac, June and July.

The Black-whiskered Vireo was very common in the two smaller islands of the group. The skins show no differences when compared with Cuban examples.

VIREO CRASSIROSTRIS CRASSIROSTRIS (Bryant).

Vireo alleni Cory, Auk, Oct. 1886, **3**, p. 500–501, Grand Cayman.

Seventeen specimens, both sexes, all adult, Grand Cayman, Little Cayman, and Cayman Brac, April, May, June, and July.

This series critically compared with our sixty-four skins from the Bahamas proves beyond a doubt that the much discussed *V. alleni* is absolutely identical with the Bahama bird. All the Cayman examples are in the yellow phase of plumage. They correspond exactly with yellow specimens from the Bahamas from Inagua to New Providence, the type locality of *V. crassirostris.* The three characters that Ridgway in his Birds of North and Middle America thought might distinguish *V. alleni,* all prove illusive. The browner back in the specimens he examined was due entirely to discoloration from the now famous chemical preservative used by Maynard; the outermost primary is not smaller; and the pale wing-bands are not broader.

Todd (Annals Carnegie mus., 1911, **7**, p. 428–430) has discussed at length the color-phases of *V. crassirostris,* and I wholly agree with him that the gray and the yellow (the so-called *Vireo crassirostris flavescens* Ridg.) specimens, represent nothing but extremes of color-variation in one and the same subspecies.

Examples from the different islands of the Caymans are all quite alike.

MNIOTILTIDAE.

DENDROICA PETECHIA PETECHIA (Linné).

Dendroica auricapilla Ridg., Proc. U. S. N. M., Aug. 1888, **10**, p. 572, Grand Cayman.

Thirteen specimens, both sexes, adults and two young, Grand Cayman, Little Cayman, and Cayman Brac, April, May, and July.

This series together with four skins from the Caymans already in the M. C. Z. I have compared most carefully with a fine set of Jamaican specimens, with the result that I find no way in which to separate them. Ridgway in his Birds of North and Middle America recognizes *auricapilla* as differing from *petechia* on the grounds of "decidedly shorter wing and larger bill and feet." His own measurements, however, which followed, show very trifling differences. My measurements of eight adult males from the Caymans, the wing is: — 62–65, (63.81); exposed culmen, 10–11.5 (10.62). In eight adult males from Jamaica, the wing is:— 62–67 (64.5); exposed culmen, 10–11 (10.68). I can see no differences at all in the feet.

There are no differences in specimens from the three islands of the Caymans.

Dendroica petechia petechia can be separated from *D. p. gundlachi* Baird of Cuba by slightly paler colors and more extensively ochraceous crown.

DENDROICA VITELLINA VITELLINA Cory.

Ten specimens, both sexes, all adult, Grand Cayman, April and May.

This fine island form confined to Grand Cayman, was in Brown's experience a very uncommon bird and he told me that it was with difficulty that he got even the ten noted above.

DENDROICA VITELLINA CRAWFORDI Nicoll.

Thirty-seven specimens, both sexes, adults and young, Little Cayman and Cayman Brac, June and July.

This is a well-marked subspecies whose characters were accurately noted by Nicoll, (Bull. B. O. C., 1904, **14**, p. 95) who also figured it (Ibis, 1904, ser. 8, **4**, pl. 11, f. 1).

It is an abundant bird in the two smaller islands, and is quite the same in both.

COEREBIDAE.

* COEREBA SHARPEI (Cory).

Twenty-eight specimens, both sexes, all adult, Grand Cayman, Little Cayman, and Cayman Brac, April, May, June, and July.

Brown's specimens from Grand Cayman are unfortunately not comparable with his series from Little Cayman and Cayman Brac, and I am unable to say whether the differences shown by birds from the two smaller islands, when compared with examples from Grand Cayman, are seasonal or not. I am inclined, however, to regard these differences as only seasonal. The Grand Cayman birds, all taken in April and May, were in worn and somewhat faded breeding plumage, while those from Little Cayman and Cayman Brac, taken in late June and July, had completed or were just completing the postnuptial moult, and were therefore all in what might be called fresh autumnal plumage. The upper parts in the Grand Cayman specimens are dull brownish black; the yellow of the under parts is pale and dull. The upper parts in the Little Cayman and Cayman Brac skins are grayish black with a slight olivaceous cast; the yellow of the under parts is richer and rather more orange. Brown noted that the "skin at corners of mouth, red" in the Grand Cayman bird; "skin at corners of mouth, flesh-color" in Little Cayman and Cayman Brac specimens. This possibly also has to do with the breeding season.

ICTERIDAE.

* HOLOQUISCALUS CAYMANENSIS CAYMANENSIS (Cory).

Four specimens, three males and a female, all adult, Grand Cayman, May.

Brown had to spend so much time while in Grand Cayman searching for the rare species, that he rather neglected the Grackle and some of the other very common birds.

This is a very well-marked insular subspecies peculiar to Grand Cayman.

HOLOQUISCALUS CAYMANENSIS CARIBAEUS Todd.

Fourteen specimens, both sexes, adults and one young, Little Cayman and Cayman Brac, June and July.

The Grackle of the two smaller islands which differs from true *H. caymanensis* of Grand Cayman in its much larger size and stronger bill, has always been referred to *H. gundlachii* (Cassin) of eastern Cuba. I had in the present paper corrected this old error, and had named the form as new, arriving at the same conclusions as Todd, except that he did not know the bird of Cayman Brac and Little Cayman, which is identical with that inhabiting the Isle of Pines and western Cuba.

Todd's paper, The Birds of the Isle of Pines, Annals of the Carnegie museum, **10**, nos. 1–2, (dated Jan. 1916, *but received* by M. C. Z. Mar. 1, 1916), containing a description of the form, came just in time to allow me to change the name while reading proof.

ICTERUS BAIRDI Cory.

Seventeen specimens, both sexes, adults, and five immature (one year old?) birds still carrying a partly or wholly greenish yellow tail, Grand Cayman, April, May, and June. A nest made of palm fibres and attached to a hemp palm leaf about sixty feet from the ground was found 28 May; the nest contained three young birds.

This splendid island species confined to Grand Cayman differs from *I. leucopteryx* (Wagler) of Jamaica, from which it obviously was derived, in being bright golden yellow only slightly tinged with olive on the head, and just a trifle darker on the back than it is below. It is also a little smaller and has a slightly slenderer and more delicate bill.

Baird's Oriole has always been extremely rare in collections, in fact besides our series there exist only Cory's original specimens and two in the Tring Museum that were collected by Taylor when he visited the island in 1896 for the Hon. Walter Rothschild.

The species seems to be on the verge of extinction. Why this is I can offer no suggestion. Certainly *I. leucopteryx* is common enough in Jamaica and adapts itself to all the changes man makes there.

Brown found this Oriole scattered here and there at wide intervals in the island and told me he thought it was one of the rarest birds he had ever hunted for.

TANAGRIDAE.

* SPINDALIS SALVINI Cory.

Fifty-five specimens, both sexes (only five females) all adult, Grand Cayman, April and May.

This is a fine, large species peculiar to Grand Cayman. Its nearest relative is clearly *S. pretrei* (Lesson) of Cuba. Its bill though of course larger than in the Cuban species, the bird itself being much larger, is very like it, and quite different from the heavy coarse bill of *S. benedicti* Ridg. of Cozumel Island.

The female, I believe, was previously unknown; in color it is somewhat like the female of *S. pretrei,* (it is of course much larger), the upper parts are, however, paler and more grayish olive, the under parts are more uniform, the belly and under tail coverts not whitish but dull, pale yellowish olive, and the chest is slightly paler olive.

This is another of the Cayman birds that has been very rare in collections; Brown, however, tells me that it is really not uncommon in Grand Cayman, but that it keeps itself hidden away in the dense scrubby woods where it is difficult to shoot, females being especially hard to find.

FRINGILLIDAE.

* TIARIS OLIVACEA OLIVACEA (Linné).

Euetheia coryi Ridg., Auk, Oct. 1898, **15**, p. 322, Cayman Brac.

Nineteen specimens, both sexes, all adult, Grand Cayman and Cayman Brac, April, May, and July.

The species has been recorded from Little Cayman, but Brown during his short stay in that island did not find it.

Some years ago Ridgway separated the Cayman Brac form based on specimens collected there by Maynard. Some of Maynard's skins of this bird are in the M. C. Z. so discolored by his chemical preservative as to be practically unidentifiable, and I am afraid even Ridgway was deceived by them. Specimens in the present collection from Cayman Brac are absolutely identical in color as well as in size with those from Grand Cayman. In adult males from Grand Cayman the wing runs 49–51.5; in adult males from Cayman Brac the wing runs 48–51, the tips of the primaries are slightly more worn down in the Cayman Brac skins. Birds from the Caymans are as a whole like Jamaican specimens, and are slightly different from the average of Cuban examples.

We have now in the M. C. Z. upwards of 150 skins of *T. olivacea* from the Greater Antilles, and after a very critical study of these specimens, I think the species might by very close splitting be subdivided. Individual variation, however, is so great and the characters that separate birds from the various islands so subtle that the wisdom of so doing is very questionable. If subdivided, the forms of the Greater Antilles would stand, probably, as follows: —

Tiaris olivacea olivacea (Linné).

Haiti and Santo Domingo.

Slightly browner olive-green above and on flanks; yellow of throat often very pale (the color of the throat-patch is, however, subject to much individual variation in all the forms).

Tiaris olivacea lepida (Linné).

Cuba and Isle of Pines.

Inclined to be darker and duller, than are the other forms, the upper parts often dull dusky olive-green; the flanks darker and encroaching more on belly; belly seldom yellowish.

Tiaris olivacea adoxa (Gosse).

Jamaica and the Caymans.

Usually paler and more grayish olive-green above and on flanks; belly paler and often washed with pale yellowish.

I have no doubt that the subject of Gosse's plate was a young individual of this form. If, however, Gosse's bird is considered unidentifiable, then the name *coryi* Ridgway becomes available for it.

Tiaris olivacea bryanti (Ridg.).

Porto Rico.

Averaging slightly smaller than the other races, and slightly brighter olive-green above; belly more yellowish. Perhaps the best of the Greater Antillean forms.

* MELOPYRRHA TAYLORI Hartert.

Fifty-one specimens, both sexes, adults and immature (one year old?) males, Grand Cayman, April, May, and June.

This is one of the very strongly characterized species of Grand Cayman. Brown found it to be far from uncommon, though usually keeping well concealed in the scrubby woods.

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ANTS COLLECTED IN TRINIDAD BY PROFESSOR ROLAND THAXTER, MR. F. W. URICH, AND OTHERS.

By William Morton Wheeler.

CAMBRIDGE, MASS., U. S. A.
PRINTED FOR THE MUSEUM.
March, 1916.

No. 8.— *Ants collected in Trinidad by Professor Roland Thaxter, Mr. F. W. Urich, and Others.*

CONTRIBUTIONS FROM THE ENTOMOLOGICAL LABORATORY OF THE BUSSEY INSTITUTION, HARVARD UNIVERSITY. NO. 108.

By William Morton Wheeler.

Formicidae.

1. *Ectatomma tuberculatum* Olivier. ☿ ♀.— Port of Spain and Sangre Grande (Thaxter).
2. *Ectatomma ruidum* Roger. ☿.— Port of Spain (Thaxter); Chaguanas (Urich).
3. *Neoponera obscuricornis* Emery var. *latreillei* Forel. ☿.— Caura (Urich).
4. *Neoponera unidentata* Mayr. ☿.— Port of Spain (Thaxter).
5. *Pachycondyla crassinoda* Latreille. ☿ ♀.— Port of Spain (Thaxter).
6. *Pachycondyla harpax* Fabricius. ☿.— Port of Spain (Thaxter).
7. *Pachycondyla impressa* Roger. ☿.— Port of Spain (Thaxter).
8. *Euponera* (*Mesoponera*) *constricta* Mayr. ☿ ♀.— Port of Spain (Thaxter).
9. *Euponera* (*Trachymesopus*) *stigma* Fabricius. ☿ ♀.— Port of Spain (Thaxter).
10. *Ponera opaciceps* Mayr. ☿.— Aripa Savanna (Thaxter).
11. *Odontomachus haematoda* Linné. ☿ ♀.— Port of Spain, Gasparee Island, and Sangre Grande (Thaxter).
12. *Odontomachus haematoda* Linné subsp. *insularis* Guérin var. *hirsutiusculus* F. Smith. ☿.— Port of Spain (Thaxter).
13. *Odontomachus haematoda* Linné subsp. *meinerti* Forel. ☿.— Port of Spain (Thaxter).
14. *Anochetus inermis* Ern. André var. *meinerti* Forel. ☿ ♀ ♂.— Chaguanas (Urich); Port of Spain (Thaxter).

The worker and female of this variety differ from those of the typical form in having the superior border of the petiole distinctly excised and the inner border of the mandibles with three teeth.

15. *Anochetus* (*Stenomyrmex*) *emarginatus* Fabricius (typical). ☿.— Port of Spain (Thaxter); Ariopita Valley (H. D. Chapman).
16. *Eciton burchelli* Westwood. ☿.— Port of Spain (Thaxter).
17. *Eciton burchelli* Westwood var. *urichi* Forel. ☿.— Port of Spain (Thaxter); Erin (Urich).

I doubt whether this variety will prove to be valid. Among a large number of specimens from the same colony received from Urich, there are numerous transitions in color to the typical form.

18. *Eciton* (*Labidus*) *crassicorne* F. Smith. ☿.— Matura (Urich); Port of Spain (Thaxter).
19. *Eciton* (*Acamatus*) *pilosum* F. Smith. ☿.— Aripa Savanna (Thaxter).
20. *Pseudomyrma championi* Forel var. *paulina* Forel. ☿.— Port of Spain (Aug. Busck and Thaxter).
21. *Pseudomyrma excavata* Mayr. ☿.— Port of Spain (Thaxter).
22. *Pseudomyrma pallida* F. Smith. ☿.— Aripa Savanna (Thaxter).
23. *Pheidole* (*Macropheidole*) *fimbriata* Roger. ♃.— Port of Spain (Thaxter).
24. *Crematogaster brasiliensis* Mayr. ☿.— Aripa Savanna and Sangre Grande (Thaxter).
25. *Crematogaster limata* F. Smith subsp. *parabiotica* Forel. ☿.— Port of Spain and Gaspari Island (Thaxter).
26. *Monomorium floricola* Jerdon. ☿.— Port of Spain (Thaxter).
27. *Megalomyrmex bituberculatus* Forel. ☿.— Arima (Urich); Port of Spain (Thaxter).
28. *Tranopelta gilva* Mayr. ♀ ♂.— Port of Spain (Aug. Busck).
29. *Solenopsis geminata* Fabricius. ☿.— Port of Spain (Thaxter); Chaguanas (Urich).
30. *Solenopsis minutissima* Emery. ☿.— Trinidad (Thaxter).
31. *Solenopsis altinodis* Forel. ☿.— Port of Spain (Thaxter).

This species, which is easily recognized by the peculiar high petiolar node, rectangular in profile and laterally compressed, the absence of distinct clypeal ridges and the distinctly marginate epinotum, has been recorded from Trinidad by Forel. The types are from Zigzag, Venezuela.

32. *Solenopsis tenuis* Mayr. ☿.— Port of Spain (Thaxter).
33. *Wasmannia auropunctata* Roger. ☿ ♀.— Port of Spain (Thaxter).

34. *Mycocepurus smithi* Forel. ☿.— Diego Martin (Urich).
35. *Apterostigma wasmanni* Forel. ☿.— Four Roads, Port of Spain (Thaxter); "from fungus garden under a log."
36. *Apterostigma urichi* Forel. ☿.— Caparo (Thaxter); "from fungus garden under a log."
37. *Trachymyrmex urichi* Forel. ☿.— Ariopita Valley (H. D. Chapman); Gasparee Island (Thaxter).
38. *Trachymyrmex humilis*, sp. nov.

Worker. Length 2.2–2.5 mm.

Mandibles rather long, with concave external borders, three large apical and several smaller basal teeth. Head subrectangular, as broad as long, with broadly and feebly excised posterior and rather convex lateral borders and rounded posterior corners. Eyes moderately convex. Clypeus short, with nearly straight, entire anterior border. Expanded anterior lobes of frontal carinae moderately large, rounded, not angular, posterior ridges diverging but not reaching the posterior corners of the head. Praeorbital carinae straight, not curved inward across the antennal scrobes, terminating a little behind the eyes. Antennal scapes moderately stout, reaching a distance not exceeding their greatest transverse diameter beyond the posterior corners of the head. Joints 2–8 of the funiculi not longer than broad, two terminal joints forming an indistinct club, the penultimate longer than broad and half as long as the last joint. Thorax with the pro- and mesonotum rather convex and rounded in profile, the mesoëpinotal constriction short and deep. Inferior pronotal spines short, moderately acute. Epinotum much higher than long, the base in profile very convex anteriorly, sloping behind, broadly sulcate above, somewhat longer than the declivity, the spines reduced to two teeth which are only slightly longer than broad at their bases, directed upward, outward, and backward. Petiole small, not longer than high, the node feebly developed, acute in profile, with longer concave anterior and short concave posterior slope. Postpetiole very large, more than twice as broad as the petiole, as long as broad, broadest behind, with a median semicircular impression at the posterior border; in profile the node is very convex and high in front, the remaining dorsal surface flattened. Gaster suboblong, with rounded anterior and posterior corners, a little longer than broad, with straight, marginate sides, its upper surface evenly and feebly convex, without any longitudinal impressions. Legs moderately long.

Mandibles shining, with a few very coarse, elongate punctures.

Remainder of body opaque, very densely punctate-reticulate. The tubercles on the head, thorax, petiole, postpetiole, and gaster are small and rather uniformly distributed, noticeably so on the posterior corners of the head and dorsal surface of the gaster. On the front and vertex of the head they are somewhat elongate so that the general effect is that of several frequently interrupted rugae. Tibiae and femora covered with minute, uniformly distributed tubercles. What correspond to the spines and projections on the head and thorax of other species of Trachymyrmex are reduced to tubercles not much smaller than the teeth on the epinotum.

Hairs yellowish, very short, hooked, moderately abundant but not conspicuous. Pubescence of the same color, short, distinct only on the antennal funiculi.

Uniformly brownish ferruginous; mandibles a little darker, legs a little paler than the remainder of the body.

Two specimens; one from Gasparee Island and one from Port of Spain (Thaxter).

This species is very peculiar in its small size, small petiole, large postpetiole, and the great reduction of the spines and tubercles on the head and thorax.

39. *Acromyrmex octospinosus* Reich. ☿.— Gasparee Island (Thaxter); Ariopita Valley (H. D. Chapman).
40. *Atta cephalotes* Linné. ☿.— Port of Spain and Sewa Valley (Thaxter).
41. *Cryptocerus pusillus* Klug. ☿.— Aripa Savanna (Thaxter).
42. *Cryptocerus* (*Zacryptocerus*) *clypeatus* Fabricius. ☿.— Sangre Grande (Thaxter); Port of Spain (U. S. N. M.).
43. *Cryptocerus* (*Cephalotes*) *atratus* Linné. ☿.— Port of Spain (Thaxter).
44. *Strumigenys saliens* Mayr. ☿.— Port of Spain (Thaxter).

Codiomyrmex, gen. nov.

Worker. Monomorphic, closely related to Strumigenys F. Smith, Epitritus Emery, and Glamyromyrmex Wheeler, but differing in the shape of the head. Mandibles large, swollen, triangular, their apical margins with numerous, regular, acute teeth. Clypeus well developed, projecting over the extreme bases of the mandibles and not separated behind by distinct sutures from the head. Frontal carinae widely separated, expanded horizontally and continued backward to form sharp lateral margins as far as the posterior corners of the head, overarching broad scrobes for the antennae dorsal to the eyes, which are small but otherwise well developed. Ocelli absent. There is a short, sharp longitudinal carina ventral to the insertion of each antenna and a small acute tooth at each lateral corner of the gula near the lateral insertion of the mandible. Ocelli absent. Frontal area represented by a smooth, transverse region in the sculpture of the head; frontal groove represented by a raised line extending back to the vertex. Antennae, robust, 6-jointed. Thorax, petiole, postpetiole, and gaster much as in Strumigenys. Spongiform appendages well developed on the petiole, postpetiole, and base of gaster. Head coarsely sculptured. Squamiform or clavate hairs absent, but both the body and appendages covered with long, soft, dense, pointed hairs.

45. *Codiomyrmex thaxteri*, sp. nov. (Fig. 1).

Worker. Length nearly 2 mm.

Mandibles very convex dorsally and laterally, somewhat narrowed at their insertions, their straight apical margins furnished with numerous, crowded, acute, and equal teeth. Head subtriangular, a little

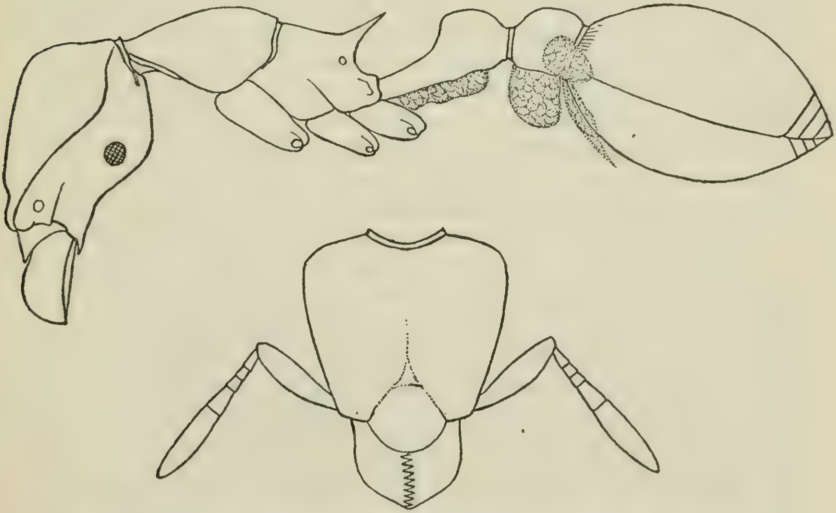

Fig. 1. *Codiomyrmex thaxteri*, sp. nov. Body of worker in profile; head of same from above.

longer than broad, decidedly broader behind than in front, with straight sides, rounded posterior corners, and narrow, excised, and marginate occipital border. In profile the head is very convex in the region of the vertex above and posterior portion of the gula below, flattened in front and on the sides to the sharp edge of the frontal carinae and their backward continuations. Clypeus rather concave, about as long as broad, with semicircular, entire anterior border. Eyes convex, at about the middle of the head, but near the ventral surface and not visible when the head is seen from above. Antennae robust, scapes terete but distinctly swollen, first funicular joint as long as the second and third together. These are subequal and scarcely longer than broad. Third joint longer than broad and nearly $\frac{1}{3}$ as long as the terminal joint. Thorax slender, through the pronotum about half as broad as the head, broadest through the humeri which are very projecting and distinctly angular or conical. Pro- and mesonotum in profile gently convex, not separated by a suture, the mesonotum laterally marginate and with a median longitudinal ridge, the mesopleurae high and rather concave. The lateral marginations of the mesonotum are continued back over the base of the epinotum into the spines, which are well developed, straight, and acute, nearly as long as the base of the epinotum and directed backward, upward, and outward. Their bases are laterally compressed and translucent below. Epinotal declivity concave, somewhat shorter than the base, its inferior angles compressed but not acute. Petiole with a long peduncle, as long as the node, which rises abruptly in front and has a gently convex, backwardly sloping dorsal surface; seen from above the node is as long as broad and evenly rounded and submarginate on the front and sides. Attached to the ventral border of the peduncle and node is a long, compressed, band-shaped, transparent, spongiform appendage. Postpetiole from above, transversely elliptical, nearly twice as broad as the petiolar node and twice as broad as long, in profile a little longer than high, evenly convex above, with a large and prominent ventral and two smaller, lateral spongiform appendages. Gaster a little larger than the head, elliptical, with nearly straight anterior and rather sharply marginate lateral borders, its ventral as convex as its dorsal surface and nearly the entire surface formed by the first segment. Its anteroventral surface is furnished with a flat, squamiform and pointed spongiform appendage. Legs rather long and stout.

Mandibles shining, evenly and sparsely punctate. Head subopaque; clypeus and upper surface of head reticulate-rugose and coarsely punctate; antennal scrobes and gula densely and evenly punctate; region of the frontal area smooth and shining. Thorax smooth and shining, except the epinotum, the base of which is coarsely, the declivity and sides more finely reticulate-punctate. Petiole and postpetiole shining, the node of the former opaque, coarsely and somewhat longitudinally reticulate-rugose, the node of the latter coarsely and sparsely punctate. Gaster smooth and shining, its extreme base with short, longitudinal rugae. Antennal scapes coarsely and densely punctate, opaque; legs smooth and shining.

Hairs yellowish gray, very fine, long, dense, flexuous, and erect, covering the whole body and legs, as long on the latter as on the former, shorter and subappressed on the antennae, where they are if anything even denser. Pubescence absent.

Castaneous brown; clypeus, head, and antennal scapes black; mandibles, bases of antennal funiculi, neck, knees, tibiae, tarsi, anterior portion of first gastric segment, and whole of terminal gastric segments, deep red.

Described from three specimens taken by Professor Thaxter in the neighborhood of Port of Spain.

This species is very easily recognized by the singular shape of the head and peculiar fleece-like pilosity of the body. I have made it the type of a distinct genus, though it is evidently much like a Strumigenys, except in the structure of the head, because I believe that this latter genus is soon destined to suffer disintegration into a number of subgenera or genera. This fate has already overtaken several other ant-genera (Camponotus, Formica, Crematogaster, Monomorium, Pheidole, etc.) that have become unwieldy through accumulation of species which even a very conservative myrmecologist must regard as heterogeneous.

46. *Dolichoderus attelaboides* Fabricius. ☿.— Arima (Urich); Port of Spain (Thaxter).
47. *Dolichoderus decollatus* F. Smith. ☿.— Port of Spain (Thaxter).
48. *Dolichoderus* (*Hypoclinea*) *bidens* Linné. ☿.— Tamana (Urich).
49. *Dolichoderus* (*Hypoclinea*) *championi* Forel var. *taeniatus* Forel. ☿. —Port of Spain (Thaxter). A single worker of very small size, but agreeing in color and structure with cotypes from Colombia.
50. *Dolichoderus* (*Hypoclinea*) *championi* Forel subsp. *trinidadensis* Forel. ☿.— Port of Spain (Thaxter).

A single worker differing from a cotype specimen received from Professor Forel only in having the head, tibiae, and antennal scapes dark brown.

51. *Dolichoderus* (*Monacis*) *bispinosus* Olivier. ☿ ♀ ♂.— Port of Spain (Thaxter); Erin (Urich).
52. *Dolichoderus* (*Monacis*) *debilis* Emery. ☿.— Matura (Urich); Sangre Grande (Thaxter).
53. *Iridomyrmex dispertitus* Forel subsp. *micans* Forel. ☿.— Port of Spain (Thaxter).
54. *Tapinoma melanocephalum* Fabricius. ☿. — Aripa Savanna (Thaxter).
55. *Azteca chartifex* Forel. ☿.— Arima (Urich).
56. *Azteca chartifex* Forel subsp. *decipiens* Forel var. *lanians* Forel. ☿ ♀.— Arima (Urich).
57. *Azteca barbifex* Forel. ☿.— Port of Spain (Thaxter).
58. *Azteca trigona* Emery subsp. *mediops* Forel. ☿.— Port of Spain (Thaxter); Ariopita Valley (H. D. Chapman).
59. *Azteca foreli* Emery subsp. *ursina* Forel. ☿.— Chatham, "on cacao" (Urich).
60. *Azteca velox* Forel. ☿.— Arima (Urich).
61. *Azteca velox* Forel var. *nigriventris* Forel. ☿.— Port of Spain (Thaxter).
62. *Prenolepis* (*Nylanderia*) *longicornis* Latreille. ☿. — Sangre Grande (Thaxter).
63. *Prenolepis* (*Nylanderia*) *vividula* Nylander. ☿.— Port of Spain (Thaxter).
64. *Camponotus* (*Dinomyrmex*) *agra* F. Smith. ☿.— Platanal (Urich).
65. *Camponotus* (*Myrmothrix*) *abdominalis* Fabricius. ☿.— Port of Spain (Thaxter); Ariopita Valley (H. D. Chapman).
66. *Camponotus* (*Myrmothrix*) *femoratus* Fabricius. ☿.— Port of Spain (Thaxter).
67. *Camponotus* (*Myrmobrachys*) *excisus* Mayr. ☿.— Port of Spain (Thaxter).
68. *Camponotus* (*Myrmobrachys*) *senex* F. Smith. ☿.— Port of Spain (Thaxter).
69. *Camponotus* (*Myrmobrachys*) *lindigi* Mayr. ☿.— Gasparee Island (Thaxter).
70. *Camponotus* (*Myrmobrachys*) *zoc* Forel. ☿.— Ariopita Valley (H. D. Chapman).
71. *Camponotus* (*Myrmorhachis*) *latangulus* Roger. ☿.— Port of Spain (Thaxter).
72. *Camponotus* (*Myrmorhachis*) *bidens* Mayr. ☿.— Port of Spain (Thaxter).

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BATS OF THE GENUS CORYNORHINUS.

By Glover M. Allen.

With One Plate.

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No. 9.— *Bats of the Genus Corynorhinus.*

By Glover M. Allen.

Introduction.

Specimens of the Big-eared Bats of the genus Corynorhinus have, until very lately, been few in museums, and most of those available to previous writers have been preserved in alcohol, so that they were of little value in determining color variation. The desirability of bringing together a large series of skins for comparison was emphasized twenty years ago by Miller (1897) in his review of the Vespertilionidae of North America, but no later attempt at a revision of the genus has been made. Thanks to the generous interest of Professor Theodore Lyman, the Museum of Comparative Zoölogy has lately acquired a small series of these bats from southeastern California, and the identification of these and other specimens in the Museum has induced me to undertake a general review of the genus. I have been fortunate in being able to assemble most of the skins and skulls available in American museums, some 126 specimens in all, covering practically the entire known range of these bats.

Acknowledgements.

My thanks are due to the officers of several institutions for the loan of specimens under their charge, and particularly to Mr. H. W. Henshaw, Chief of the Biological Survey of the U. S. Department of Agriculture and to Mr. Gerrit S. Miller, Jr., of the U. S. National Museum for use of the series in the unrivalled collections at Washington. For the loan of valuable material from California, including the type of *C. m. intermedius,* I am indebted to Dr. Joseph Grinnell and Mr. H. S. Swarth of the Museum of Vertebrate Zoölogy of the University of California. Acknowledgements are also gratefully made to the following persons and institutions: Dr. J. A. Allen and Mr. R. C. Andrews of the American Museum of Natural History; Mr. W. H. Osgood of the Field Museum of Natural History; Mr. Junius Henderson of the University of Colorado Museum; Mr. C. D. Bunker of the University of Kansas Museum, Dr. H. L. Ward of the Public Museum

of Milwaukee, Prof. Z. P. Metcalf of the North Carolina College of Agriculture, Prof. F. Payne of Indiana University, and Mr. M. L. Church of Marshall, N. C.

Generic Affinities.

The Big-eared Bats of the genus Corynorhinus take the place of the Old World vespertilionine genus Plecotus in North America. In essential characters the two genera are very similar, and are evidently closely related. Miller (1907, p. 225) in his "Families and Genera of Bats" considers that "the great development of the glandular masses on muzzle, and the absence of the distinct lachrymal ridge, distinguish this genus sufficiently from Plecotus," to which LeConte and contemporary writers at first referred specimens. The shape of the nostrils is also diagnostic, but the presence of a distinct lachrymal ridge in a new species from Mexico (see p. 352), invalidates that character as distinctive of Plecotus. In 1864, Harrison Allen used Synotus of Keyserling and Blasius for the American bat, but in the following year he erected for it the new genus Corynorhinus, by which it continues to be known, although Dobson in his Catalogue of Chiroptera in the British Museum (1878) took the more conservative course of regarding it as a subgenus of Plecotus. The dental formula — $i\ \frac{2-2}{3-3}$ $c\ \frac{1-1}{1-1}$, $pm\ \frac{2-2}{3-3}$, $m\ \frac{3-3}{3-3} = 36$ — is the same in both genera and shows but slight numerical reduction over that of Myotis, in the presence of two in place of three upper premolars on each side. In view of this somewhat primitive or unreduced tooth formula it is perhaps less surprising to find among the many specimens examined a single one with *three* upper incisors. This condition is perhaps to be considered reversionary to the more primitive state in which the full number of three upper incisors characteristic of placental mammals, is present. It has been generally assumed that it is the innermost upper incisor that was the first to be lost in all bats with two incisors, partly because of the "correspondence of the two upper teeth with the two outer of the lower jaw when the maximum set is present, and also, even more strongly, by the general tendency throughout the group for the premaxillaries to become reduced, particularly along the inner edge" which would "inevitably result in eliminating that part of the bone in which the first incisor grows" (Miller, 1907, p. 27). Andersen (1912, p. xxiv) without going further into the matter, asserts, however, that the outermost incisor (i^3) is the one lost in all known Chiroptera. In the specimen of Corynorhinus mentioned (*C. m. townsendii*, Biol. Surv. Coll. 150273, from Happy Camp, California) it is evident from the agreement in form, that the two inner incisors correspond with the two normally present in the genus, and that the supernumerary one has been added at the *outer* side,— is in fact the i^3 usually missing in all living bats. In outline (Plate 1, fig. 1) this tooth is roughly a right-angled triangle with its height a little less than its base. It is a very little shorter than i^2 but much stouter, and with a long base, rather than with the terete form characteristic of the second incisor. In crown view it has a broad cutting edge, as broad as the crowns of the other incisors. The skull of the specimen is unfortunately in fragments, and the corresponding teeth of the left side are lost, but the remaining teeth are normal. The case is instructive as indicating not only that it is i^3 that has been lost in the Chiroptera, but that in this case, it was probably a larger tooth than i^2 which is retained.

Geographic Distribution.

The general limits of distribution for the genus are now fairly well ascertained. In the East it has been reported from Micanopy, Florida, in the northern part of the peninsula, but to the southward of that point there are no records. Northward it occurs throughout Georgia and South Carolina, to western North Carolina and Virginia. West of the Alleghenies, the northward limit of the range includes Kentucky, southern Indiana, and west of the Mississippi swings north again to southwestern South Dakota and the Yellowstone Park in northwestern Wyoming. Between the Rocky Mountains and the Sierra Nevada the records are few, but the genus undoubtedly is found in southern Idaho and in Nevada. On the west coast, Vancouver Island, British Columbia, seems to be the northernmost limit, and thence it ranges south in the Sonoran zones, to the tableland of Mexico as far as Oaxaca and Vera Cruz. Apparently it has not yet been discovered in the peninsula of Lower California. In general it is characteristic of the Austral zones as defined by Merriam, though in the northwest, the subspecies *townsendii* is mainly confined to the Transition and even enters the Boreal zone. This more northward range in the northwest is possibly indicative of a more extended northward distribution in ancient times, when we may assume that the ancestral stock was enabled to reach America from northeastern Asia by following land connections. In the particular accounts of the forms recognized in this paper, I have indicated more precisely the limits of distribution of each.

HABITS.

The Big-eared Bats are essentially cave-dwellers. In the West they frequently haunt the abandoned shafts and tunnels made by miners. Numbers of them may inhabit a single such tunnel, but they appear to rest singly, scattered along the rock walls, rather than in clusters. J. K. Townsend (1839) in the journal of his expedition to the Columbia River, Oregon, in 1834, relates that they often lived in the storehouses at the forts, and were considered by the fur traders to be beneficial in ridding such places of Dermestes.

There is no evidence to indicate that any of the forms are migratory. In the northern part of their range they retire to suitable caverns to hibernate. Hahn (1909) records finding specimens in caves at Mitchell, Indiana, during the winter of 1906–7 and Butler (1895) obtained two from Greencastle, Ind., 23 December, 1894. Brimley (1905) reports one taken 1 February, 1893, in Bertie Co., North Carolina. The University of Colorado has two from Boulder County in that State, captured in mid-winter, one on 21 January, 1912, in a mine-tunnel where the temperature was 48° F., the other on 23 February, 1910, in a tunnel at fifty feet from the surface (altitude 7760 feet).

The young are probably born in early July or even earlier in the southern part of the range. Stephens (1906, p. 265) records a female of *C. m. pallescens* captured at San Diego, California, on 25 April, that contained a single foetus. In the San Jacinto Mts., of Southern California, Grinnell and Swarth (1913, p. 379) collected a female containing a single large foetus about 5 June. They found that the adult bats in a resting posture folded the long ears back against the sides, close to the body, a habit which Hahn (1909) seems to have been the first to record in the case of specimens from Indiana. In a freshly killed specimen, however, the ears project forward.

HISTORY AND NOMENCLATURE.

What is perhaps the first mention of a bat of this genus, is found in Clapton's (1722, p. 594) account of the animals and other products of

Virginia. Among mammals, he lists "*Bats,* as I remember, at least two sorts; one a large sort with *Long Ears,* and particularly long straggling *Hairs;* the other much like the *English,* something larger, I think, very *Common.*" The long ears of the first sort may perhaps identify it with Corynorhinus; the other was possibly an Eptesicus. It was not until 1818, however, that the naturalist Rafinesque named and briefly described *Vespertilio megalotis* from a specimen captured somewhere on "the lower parts of the Ohio" River, the Wabash, or the Green River, perhaps in Indiana. His name, which I think must hold for a bat of this genus, has been generally ignored in favor of LeConte's later name *Plecotus macrotis* based probably on specimens from Georgia. A study of the large number of skins which I have been able to assemble from many parts of the range of the genus shows, rather unexpectedly, that the bat of the eastern United States west of the Alleghenies is quite different from the dark brown, white-bellied animal of the south Atlantic and Gulf States, to which the name *macrotis* strictly applies. In the species inhabiting the interior and western parts of the United States, the contrast in color between the tips and the bases of the hairs of both surfaces is not abrupt as in *macrotis* but passes imperceptibly from a dark base to a differently colored tip, nor are the hairs of the lower surface tipped with pure white. To this species, Rafinesque's name must apply. West of the Mississippi, this species gradually becomes paler, and over the Rocky Mountain area and the Southwest is a dull buffy color. To this race of *megalotis,* Miller's (1897) name *pallescens* applies. On the humid northwest coast, a gradual darkening takes place, and a strongly marked subspecies is again recognizable, to which the name *townsendii* was given by Cooper in 1837. On the Mexican tableland, the same type of bat is found, but of a dark smoky hue and slightly reduced proportions, which I here describe as new. Apparently the white-bellied *Corynorhinus macrotis* of the Atlantic slope and Gulf States as far west at least as Louisiana, does not intergrade with the differently colored representatives to the West, and I am therefore provisionally regarding it as a distinct species. Still a third species, with very large and differently formed ears and peculiar skull is represented by a single specimen from central Mexico, and has remained hitherto undescribed. The brief synonymy given under each name in the descriptions which follow, indicates sufficiently the opinions of previous writers as to the nomenclature of this genus.

CORYNORHINUS MEGALOTIS (Rafinesque).

Rafinesque's Big-eared Bat.

Vespertilio megalotis Rafinesque, Amer. monthly mag., 1818, **3**, no. 6, p. 446.
Plecotus rafinesquii Lesson, Manuel de mammalogie, 1827, p. 96. (Renaming of Rafinesque's *V. megalotis*).
Corynorhinus macrotis Miller, N. Amer. fauna, 1897, no. 13, p. 51 (? in part, Kentucky specimen cited).

Type.— None specified, and original specimens not known to be extant.

Type Locality.— "The lower parts of the Ohio" River, probably in southern Indiana and Illinois or western Kentucky in the region between the Wabash and the Green Rivers.

Distribution.— Central eastern United States from extreme western Virginia, through Kentucky, southern Indiana and Illinois, to Kansas, intergrading with the race *pallescens* to the westward.

General Characters.— Largest of the *megalotis-macrotis* group; bases and tips of hairs, above and below, not strongly and sharply contrasted in color.

Color.— Adults: bases of the hairs, on dorsal surfaces of the body, gray or slaty gray shading by imperceptible degrees into a 'wood brown' (Ridgway, 1912) at the sides, and a 'clove brown' over the median area of the back. The amount of 'clove brown' wash over the back varies slightly in individuals, but conduces to a much darker, more drabby appearance than is found in typical *pallescens*. Downy hairs at the bases of the ears posteriorly are whitish. Ventral surfaces 'pale pinkish buff,' the bases of the hairs shading into grayish.

Immature specimens (No. 157075 Biol. Surv. Coll., Burke's Garden, Va., 7 August, 1908), are uniform dark 'hair brown' to 'fuscous' above to the bases of the hairs; below, pale 'hair brown' the hair along the sides and on the belly paling at the tips to a dirty whitish. Compared with immature *pallescens*, it is more uniformly dark, lacking the light buffy admixture. It is also darker and larger than the Mexican race.

Skull.— The skull is largest of all the *megalotis-macrotis* group, with broad depressed rostrum, and large brain case. The intermaxillary notch viewed from above is rather larger with wider-bowing sides than that of *macrotis*. The inner upper incisor is usually without trace of a secondary outer cusp, though in one of four specimens from

Burke's Garden, Virginia, a cusp is barely indicated by a minute shoulder. In *macrotis* this cusp is normally well developed.

Measurements.— No. 157076, Biol. Surv. Coll., from Burke's Garden, Bland County, Virginia: forearm 45 mm. (average of three adults 44.1); digit III, metacarpal 39.8; first phalanx 13.8; second phalanx 19; tibia 19. Collector's measurements: total length 107 mm., tail 49; hind foot 12; extent of wings 320.

Skull: greatest length 17.4 mm.; basal length 14; palatal length 8; zygomatic breadth 9; interorbital constriction 4; mastoid breadth 9.2; width of braincase 8.6; upper tooth row 6.7; lower tooth-row 7.3.

Remarks.— The discovery of a Corynorhinus distinct from *C. macrotis,* from extreme western Virginia, westward, in the eastern United States was wholly unexpected. It is the eastern representative of the desert-colored *pallescens* of west-central United States, from which it chiefly differs in its somewhat darker, more drab, coloration. The skull is a trifle larger as well. I have applied to it Rafinesque's name *megalotis,* based on specimens which he collected from " the lower parts of the Ohio" River probably in southern Indiana or western Kentucky, where the genus is known to occur at the present time (see Cory, 1912, p. 476). Rafinesque's description is brief, yet I think unmistakable in the light of our present knowledge. Nevertheless, Miller, in 1897, rejected his name as unidentifiable and applied Le Conte's later name, *macrotis,* to the species of Corynorhinus in eastern North America. The discovery of a species in the interior distinct from *macrotis* makes it necessary either to erect a new name or to recognize *megalotis* as applicable to it, and this latter course I propose to adopt. In 1818, Rafinesque sent to the editors of the American Monthly Magazine brief accounts of the animals he discovered in the course of his journey "through the western region of the United States," and gave new names to many of these. In one of these communications written in October, he gave a brief statement of certain supposed new species obtained since July, during which time he says, he had visited "the lower parts of the Ohio, the Wabash, Green River, Barrens, Prairies, and the states of Indiana, Illinois, &c." This is the general locality whence he obtained the new bat which he describes as follows:

"9. *Vespertilio megalotis* R. (Big-eared Bat.) Tail three-eighths of total length, body dark gray above, pale gray beneath, ears very large, duplicated, auricles nearly as long. Length 4 inches, breadth 12 inches."

The evident similarity to the Old World Plecotus, led Lesson in 1827 to change the genus and (as the custom then was) the specific name as well, calling it *Plecotus rafinesquii*. The description of the color ("dark gray above, pale gray beneath") though inexact, is certainly applicable to the present form and not at all to *macrotis*. The statement that the ears are "duplicated" is descriptive of the manner in which the inner rim folds upon the rest of the conch, and will apply to no other of the eastern genera with which he could have met, except possibly the very different Nyctinomus, in which the "auricle" [i. e. tragus] is not "nearly as long." Even in Corynorhinus the tragus is hardly more than half the length of the ear. The measurements given,— "length 4 inches [= 101.5 mm.], breadth 12 inches [= 304.5 mm.]" are not far from those of the Virginia specimens (lengths 107, 108, 110; extent 320, 313, 313) allowing for differences in manner of taking these dimensions. The tail is nearer one half than three eighths of the total length. In spite of slight discrepancies, I think the description can apply to no other bat of the eastern United States. The very name is diagnostic. When LeConte proposed the name *Plecotus macrotis* for the Big-eared Bat of the coast States, he acknowledges its similarity to the species of the interior, by his remark in a footnote: "There is another species with equally long ears, which are not united on the cranium; which of these is the *megalotis* of Raffin., it is impossible to say." In view of these facts, I think the propriety of using Rafinesque's name is no longer open to question.

West of the Mississippi, typical *megalotis* (of which in lack of topotypes I have assumed the Virginia specimens to be representative) grades by insensible degrees into the more buff-colored subspecies *pallescens*, and the latter again shades rather abruptly into the dark-colored *townsendii* of the humid Pacific coast area. Two specimens from Sun City, south central Kansas, in the Biological Survey Collection, though not as dark as the Virginia *megalotis* are better referable to it than to *pallescens*. Specimens from eastern and central Colorado are intermediate, but on the whole, nearer *pallescens*. To the southward as well as to the north, the limits of the range remain to be more carefully worked out.

Many years since, Dr. Harrison Allen (1864, p. 64) recorded on the authority of Professor Baird, "that specimens of a *Synotus*, probably of this species [i. e., *macrotis*], were received some years ago by the Smithsonian Institution, from Meadville," Crawford County, northwestern Pennsylvania. The specimens have been lost and no subsequent captures of this bat have been made in the State. The record, though discredited by Rhoads (1903, p. 226) may nevertheless be valid, and if substantiated, would fix nearly the northern limit for the species in the east. It is not known that the genus ranges farther north than Virginia on the eastern side of the Alleghanies, though to the westward of that range its presence at a more northerly latitude is well known.

Specimens examined.— Eight from the following localities:

Virginia: Burke's Garden, 4 (Biol. Surv.).

Kansas: Sun City, 2 (Biol. Surv.).

Colorado: 12 miles south of Lyons, Boulder Co., 1 intermediate (Univ. of Colo.); Crisman, Boulder Co., 1 intermediate (Univ. of Colo.).

Additional locality records, probably referring to this bat, are: Indiana, Greencastle (Putnam Co.) (see Cory, 1912, p. 476); Kentucky, Bowling Green (Miller, 1897).

CORYNORHINUS MEGALOTIS PALLESCENS Miller.

Pallid Big-eared Bat.

Synotus townsendi H. Allen, Smithsonian misc. coll., 1864, **7**, p. 65 (not of Cooper, 1837).

C[orynorhinus] townsendi H. Allen, Proc. Acad. Nat. Sci. Phila., 1865, p. 175 (? not of Cooper, 1837).

Corynorhinus townsendii H. Allen, Bull. **43**, U. S. N. M., 1893, p. 58, (not of Cooper, 1837).

Plecotus (Corinorhinus) townsendi Trouessart, Cat. Mamm., 1897, fasc. 1, p. 105 (in part).

Corynorhinus macrotis pallescens Miller, N. Amer. fauna, 1897, no. 13, p. 52, fig. 10.

Type.— Skin and skull 65534, U. S. N. M. (Biological Survey Collection), adult female, collected 3 August, 1894, by A. K. Fisher.

Type Locality.— Arizona: Navajo County, Keam Canyon.

Distribution.— Western United States from western Texas, Colorado, and southwestern South Dakota, to the Pacific coast of southern California. Typical *pallescens* may yet be found to occur in northern Mexico, but none have been examined from there.

General Characters. — Similar to typical *megalotis* but slightly smaller; colors paler, more buffy throughout.

Color.— Adult: no sharp contrast in color between bases and tips of hair. General effect of an average specimen (Prescott, Ariz.)

'pinkish buff,' the hairs paling on their middle third and darkening by imperceptible degrees to gray or slate gray at their extreme bases. Downy hairs at the posterior bases of the ears whitish. Below, the general appearance is 'pale ochraceous buff,' the hairs darkening gradually toward their bases to a neutral gray, except in the middle region of the throat, where usually the hairs are not perceptibly darker at base.

Immature specimens have the pelage more dusky throughout than the adults. The basal two thirds of the hairs above is nearly 'neutral gray' with short pale tips of buffy, nearly 'vinaceous buff.' Below, the color is paler, the light tips of the hairs a soiled whitish.

Color Variation.— In a large series of skins that may fairly be taken to represent *pallescens,* there is much individual variation in the intensity of coloring among adults. A specimen from Ash Creek, Graham Mts., Arizona (204375 Biol. Survey Coll.) has the basal halves of the hairs 'slate color' producing an effect much darker than usual. It may be considered a step in approach to the dark subspecies of the Mexican highlands. Two specimens (10694, 10695 Univ. of California Coll.) obtained by Dr. Joseph Grinnell at Riverside Mountain, Colorado River, southeastern California, are the brightest colored individuals I have seen, with a distinct reddish cast to the upper surface, nearly 'vinaceous cinnamon,' shading into a 'buff pink' below, the bases of the hairs only slightly darkened. The palest specimen of all is one collected in the hills back of Lone Pine, California, by Dr. Theodore Lyman's expedition of 1915. It is 'pale pinkish buff' above and nearly white below to the roots of the hairs. Apart from these slight variations *pallescens* is remarkably uniform in tint over a wide range of territory.

Skull.— The skull of this race is hardly to be distinguished from that of true *megalotis.* To the eye, it seems a trifle narrower across the rostrum but the difference is not clearly brought out by measurements. The upper inner incisor is normally without the lateral cusp characteristic of *macrotis.*

Measurements.— No. $\frac{9934}{8265}$, Coll. Amer. Mus. Nat. Hist., from Prescott, Arizona: forearm 43 mm. (average of four Arizona specimens 42.6); digit III, metacarpal 37.3 (average of four 37.5); first phalanx 13 (average of four 13); second phalanx 16 (average of four 17.2); tibia 18. Collector's measurements, No. 204375, Biol. Survey Coll., Graham Mts., Arizona, total length 102 mm.; tail 50; foot 9; extent of wings 300.

Skull: No. 204375 Biol. Survey Coll., Graham Mts., Arizona:

total length 16 mm.; basal length 13; palatal length 7.3; zygomatic breadth 8.5; interorbital constriction 4; mastoid breadth 9; width of braincase 8; upper tooth-row 6; lower tooth-row 6.5.

Remarks.— The subspecies *pallescens* is characteristic of the arid and desert country of western United States as far north at least as southern South Dakota. Its pallid buffy coloration recalls that of other mammals that dwell in a dry open country. Its intergradation with true *megalotis* to the eastward seems to be very gradual, but in the northwest as it enters the humid coastal area from western and northern California, to southern British Columbia it merges rather abruptly into the darker *townsendii.* In the southwest, it appears to range as far east as the Pecos River in Texas and probably intergrades in northern Chihuahua with the darker race of the Mexican plateau. All the specimens that I have seen from Arizona and southern California, however, seem referable to *pallescens.*

The line of intergradation with *townsendii* seems to follow the Sacramento Valley of California back of the coast range from a short distance to the south of San Francisco about as far north as Placer County, where the change comes rather abruptly. The name *intermedius* H. W. Grinnell was based on specimens from Auburn, in this County, but to my mind there is hardly room for the recognition of an additional race. The type is well within the range of variation of *townsendii*, while other specimens from the same locality are quite as pale as some specimens of *pallescens.* Further records for central and eastern California and for the states to the eastward are to be desired.

Specimens examined.— Fifty-seven, from the following localities:

Arizona: Fort Verde, 1 (Amer. Mus. Nat. Hist.).
Graham Mts., 1 (Biol. Surv.).
Pinal Co., 1 (Amer. Mus. Nat. Hist.).
Prescott, 1 (Amer. Mus. Nat. Hist.).
California: Auburn, Placer Co., 2 not typical (Univ. of Calif.).
Julian, San Diego Co., 1 (Univ. of Calif.).
Kenworthy, San Diego Co., 12 (Univ. of Calif.).
Lone Pine, Inyo Co., 4 (M. C. Z.).
Los Angeles, 1 (Pub. Mus. Milwaukee).
Oro Grande, San Bernardino Co., 2 (Biol. Surv.).
Riverside Mt., Colorado River, 2 (Univ. of Calif.).
Vallecito, San Diego Co., 2 (Univ. of Calif.).
Whitewater, Riverside Co., 1 (Univ. of Calif.).
Colorado: Boulder Co., 2, not typical (Univ. of Colo.).
Wyoming: Mammoth Hot Springs, 4 (Biol. Surv.).

Wyoming: Sand Creek, 10 miles east of Sundance, 10 (Biol. Surv.).
South Dakota: Cheyenne River, 3 (Amer. Mus. Nat. Hist.).
Custer, 7 (Biol. Surv.).

Miller and others have recorded *pallescens* from the following additional localities:

Arizona: Fort Huachuca; Keam Canyon, Navajo Co. (type locality).
California: Dulzura; Owens Lake; Owens Valley; San Diego.
Colorado: Larimer County.
Texas: East Painted Cave, near mouth of Pecos River.
Utah.

CORYNORHINUS MEGALOTIS TOWNSENDII (Cooper).

Townsend's Big-eared Bat.

Plecotus townsendii Cooper, Ann. Lyc. nat. hist. N. Y., 1837, **4**, p. 73, pl. 3, f. 6.
Plecotus macrotis Dobson, Cat. Chiroptera Brit. mus., 1878, p. 180 (not of LeConte, 1831).
Plecotus (*Corinorhinus*) *macrotis* Trouessart, Cat. Mamm., 1897, fasc. 1, p. 105 (in part).
Corynorhinus macrotis townsendii Miller, N. Amer. fauna, 1897, no. 13, p. 53, f. 8, *a*, *a′*; 9, *a*, *a′*.
Corynorhinus macrotis intermedius H. W. Grinnell, Univ. Calif. publ. Zoöl., 1914, **12**, p. 320.

Type.— None specified. The original three specimens are not known to be still in existence.

Type Locality.— Oregon, on the lower Columbia River. Townsend, (1839, p. 325) who collected the types, says that they frequent "the store houses attached to the forts" hence it is probable that since The Dalles, Fort Walla Walla, Vancouver, Fort George, and Astoria, were the forts visited, one of these furnished the three skins he collected.

Distribution.— The humid coast region from Vancouver Island, British Columbia, southward to San Francisco, California, intergrading with *pallescens* here, as well as in north central California. Inland it extends over most of (?) Washington, Oregon, and the western half of northern California.

General Characters.— A dark-colored race, characterized by the blackish bases of the hairs, with contrasted brown tips above, and pale brown wash below.

Color.— Adults: general effect above a uniform 'warm sepia.' The basal half of the hairs is dark slaty in strong contrast to the terminal half or third which is nearly 'snuff brown.' Downy hairs at the posterior bases of the ears and on their anterior rim, whitish. Below, the rich brownish of the back passes gradually into a wash of pale wood brown, nearly 'avellaneous' (Ridgway, 1912). All the hairs of the ventral surface are 'blackish plumbeous' in the basal half.

Immature specimens (76250 Biol. Survey Coll., from Comox, B. C.) are darker, the hairs nearly uniform blackish plumbeous, with a faint brown tipping, above. Below, the pale tips of the hairs are more noticeable, and the coloring is much as in the adult, though lacking the warm brownish or russet wash.

Skull.— No tangible differences can be made out that will distinguish the skull of *townsendii* from that of *pallescens*. As in the latter the second lower premolar is frequently drawn in from the axis of the tooth-row and the inner upper incisor is normally unicuspidate. In two specimens examined, however, the latter tooth has a distinct shoulder or incipient cusp (204435, 76250 Biol. Survey Coll.). Compared with *C. macrotis* the profile of the skull is more abruptly elevated from the rostrum.

Measurements.— No. 9744 Field Mus. Nat. Hist. from Goldbeach, Oregon: forearm 43 mm. (average of ten Oregon specimens 42.0); digit III, metacarpal 38 (average of ten Oregon specimens 38.4); first phalanx 12.8 (average of same ten 12.7); second phalanx 16 (average of same ten 16.8). Collector's measurements: total length 111 mm.; tail 47; hind foot 12; ear 36.

Skull: greatest length 16.2 mm.; basal length 13.5; palatal length 7.5; zygomatic breadth 8; interorbital constriction 4; mastoid breadth 9; width of braincase 8; upper toothrow 6.3; lower toothrow 7.

Remarks.— This dark brownish race is characteristic of the humid coastal area of western North America from southern British Columbia southward to the region of San Francisco, California. Inland from the coast ranges and to the south and east of San Francisco the increasing aridity causes a progressive decrease in the amount of dark pigment so that complete intergradation by imperceptible degrees takes place with the interior subspecies *pallescens*. Specimens from intermediate localities can usually be referred to one or the other, however, though occasional individuals are strictly intermediate. A skin from Mt. Veeder, Napa County, just north of San Francisco, is indistinguishable from typical *townsendii*. Another from Bear Valley, San Benito County, to the south of that place, is nearly as dark, yet a shade paler. Through the kindness of Dr. Joseph Grinnell and Mr. H. S. Swarth of the University of California, I have had for examination a very interesting series of nine skins from Auburn, Placer County, north central California, at the semi-arid western foot of the Sierra Nevada. Two of these are in dark immature pelage. Two others (7755, 19214) agree perfectly with specimens of *pallescens* from Arizona or Wyoming, though the bases of the hairs are a trifle darker than the average of that subspecies. Four, though of a richer brown than *pallescens* are yet not quite so dark as typical *townsendii* of the humid coastal area. Nevertheless they are nearer to the latter than to *pallescens*. The remaining specimen is indistinguishable in any essential particular from *townsendii* of the Oregon coast. This last example served as the type of *C. macrotis intermedius* Hilda W. Grinnell. With the advantage of more abundant material and after careful consideration, I feel unable to concur with Mrs. Grinnell in regarding these specimens as representing a recognizable race. They are clearly intermediate between *pallescens* and *townsendii;* the type can be absolutely matched by Oregon specimens of the latter, while others again, from the same locality, might without violence be referred to the former. In other words, a series of topotypes shows no characters by which they may constantly be distinguished from the two neighboring races over any considerable area. The same series was originally referred to *townsendii* by Dr. Joseph Grinnell, and the specimens are on the whole best considered as representatives of that subspecies, with a tendency toward the pallid form of the interior. The same is true of specimens from Happy Camp (Siskiyou Co.) and Bear Valley (San Benito Co.), referred by Mrs. Grinnell to '*intermedius*.' A single skin (6957 Univ. of Cal., Mus. Vert. Zool.) from Johnson's Harbor, Santa Catalina Island, California, though much too dark to be typical of *pallescens* is not so dark as typical *townsendii*. Though an intermediate specimen in color, it may for the present be considered nearer the latter. The record is of interest in connection with the occurrence of other small land mammals on this island, some of them distinct insular representatives of continental species.

Specimens examined.— Including intermediate specimens, which are nearer *townsendii* than *pallescens*, twenty-three from the following localities:

British Columbia: Comox, 1 (Biol. Surv.).

Oregon: Gold Beach, 6 (Field Mus. Nat. Hist.).
McKenzie Bridge, 3 (Biol. Surv.).
Vida 1 (Biol. Surv.).
California: Mt. Veeder, Napa Co., 1 (Biol. Surv.).
Bear Valley, San Benito Co., 2 (Biol. Surv.).
Happy Camp, Siskiyou Co. (Biol. Surv.).
Auburn, Placer Co., 7, not all typical (Univ. of Calif.).
Santa Catalina Id., 1, not typical (Univ. of Calif.).

Miller has also recorded it from Creswell, Oregon.

CORYNORHINUS MEGALOTIS MEXICANUS, subsp. nov.

Mexican Big-eared Bat.

Plecotus (*Corinorhinus*) *townsendi* J. A. Allen, Bull. Amer. mus. nat. hist., 1890, **3**, p. 176 (not of Cooper, 1837).

Corynorhinus macrotis pallescens Miller, N. Amer. fauna, 1897, no. 13, p. 52, f. 10 (in part — Mexican specimens cited).

Type.— Skin and skull, 98285, Biological Survey collection, adult female, collected by E. W. Nelson and E. A. Goldman, 25 Aug., 1899.

Type Locality.— Mexico: Chihuahua, near Pacheco.

Distribution.— The Mexican tableland, from central and western Chihuahua, southward to Oaxaca and Santa Cruz; the precise limits are not yet fully ascertained.

General Characters.— Smallest of the *megalotis-macrotis* group, the skull small with weak canines, a short and contracted rostrum with evenly tapering lateral outlines as seen from above; color dark, the hairs nearly uniform drab throughout.

Color.— Adult in summer; above, a nearly uniform 'drab,' the bases of the hairs hardly at all darker than their tips; below, the terminal third of the hairs is soiled whitish, the bases becoming gradually darker, nearly fuscous or 'benzo brown.' At the throat the dark bases show through more than elsewhere. In fall, the pelage is longer and more silky, with slightly more contrast between the tips and the bases of the hairs, the latter now decidedly darker, shading into a pale 'hair brown.' The hairs of the lower surface are tipped with a clearer whitish, washed with pinkish buff. In this pelage they approach the coloration of typical *megalotis* of the eastern United States.

Skull.— The small delicate skull is notable for its weak canines, the short and contracted rostrum. In the other races of this group the roots of the upper canines cause a distinct bulge in the outline of the snout as viewed from above, but in these small Mexican bats the gently convex and tapering outline is not noticeably interrupted. In contrast with the other races of *megalotis* the inner upper incisor is normally provided with a distinct pointed cusp at its outer side. This cusp is wanting in but one (91930, Biol. Surv. Coll.) among eighteen skulls from Mexico that I have examined. Mr. G. S. Miller, Jr., (1897, p. 53, fig. 10) records variation in respect to this cusp in a series from Guanajuato, in which both extremes of development are represented. The small size of the skull, and the short tapering rostrum distinguish it at a glance from *macrotis*.

Measurements.— The type measures: forearm 39.4 mm. (average of ten topotypes 41.1); digit III, metacarpal 37 (average of ten topotypes 37.9); first phalanx 12 (average of ten topotypes 12.1); second phalanx 16 (average of ten topotypes 16.8); tibia 18 (average of ten topotypes 18.6).

Skull: greatest length 15.6 mm.; basal length 12.5; palatal length 7; zygomatic breadth 8; interorbital constriction 3.4; mastoid breadth 9; width of brain case 7.6; upper tooth-row 6; lower tooth-row 6.2.

Remarks.— This small dark form from the Mexican highlands has till now been confused with *pallescens* of western United States. The series of skins at present available, however, shows that it is quite different in color, a very smoky appearing bat, nearly uniform in tint, with none of the buff or brown tones of *pallescens* or *townsendii*, nor the white belly of *macrotis*. In fall and winter pelage it seems to resemble *pallescens* more closely but is darker. It is odd that the accessory cusp of the inner upper incisor, usually wanting in other races of *megalotis*, should be normally present in *mexicanus*. In this respect it resembles *macrotis* of the southeastern United States, but otherwise shows no near approach to that species. It is further remarkable that the adults are indistinguishable in color from the immature individuals, which in other races are darker than the fully grown specimens.

I have provisionally considered all records of Corynorhinus from south of Chihuahua as referring to the present race, but the possibility that those recorded from Oaxaca or Vera Cruz may be still different is not to be overlooked. Through the kindness of Mr. C. D. Bunker of the University of Kansas Museum, I have before me a single specimen said to have been collected by George F. Gaumer on the Island of Cozumel, Yucatan. The skin had no original label and is apparently quite typical of *pallescens* so that it is more than likely the locality is erroneous.

For the privilege of describing this new form I am indebted to Mr. H. W. Henshaw, Chief of the Biological Survey.

Specimens examined.— Total number eighteen, from the following localities: —

Chihuahua: near Pacheco, 14 (Biol. Surv.).
Zacatecas: Valparaiso Mts., 2 (Biol. Surv.).
Jalisco: Guadalajara, 1 (Amer. Mus. Nat. Hist.).
Guanajuato: Sta. Rosa, 1 skull (Biol. Surv.).

The following additional locality records probably refer to this subspecies: San Luis Potosi, Hacienda la Parada; Michoacan, Patzcuaro; Oaxaca, Oaxaca; Vera Cruz, Jico (see Miller, 1897, p. 53).

CORYNORHINUS MACROTIS (LeConte).

LeConte's Big-eared Bat.

Plecotus macrotis LeConte, Cuvier's Animal kingdom, ed. McMurtie, 1831, **1**, appendix, p. 431.
Plecotus lecontii Cooper, Ann. Lyc. nat. hist. N. Y., 1837, **4**, p. 72, pl. 3, f. 5.
Synotus lecontii Wagner, Schreber's Säugethiere, suppl., 1855, **5**, p. 720.
Vespertilio macrotis LeConte, Proc. Acad. nat. sci. Phila., 1855, p. 436 ("Georgia").
Synotus macrotis H. Allen, Smithsonian misc. coll., 1864, **7**, no. 165, p. 63.
Corynorhinus macrotis H. Allen, Proc. Acad. nat. sci. Phila., 1865, p. 174.
Plecotus (*Corinorhinus*) *macrotis* Trouessart, Cat. Mamm., 1897, fasc. 1, p. 105.

Type.— None specified. A "dry" specimen, 4727 U. S. N. M., presented by Major LeConte, with locality entered as "United States," is listed by Harrison Allen in his Monograph of the Bats of North America, 1893. This specimen may well be the actual one on which LeConte based his description.

Type Locality.— No locality is mentioned in the original description. In a later paper, however, LeConte states (1855, p. 436) that it inhabits "Georgia," whence it is inferred that the type locality is "probably near the LeConte Plantation, 5 miles south of Riceboro," Liberty County, in that State (Miller, 1897, p. 51).

Distribution.— Southeastern United States, from North Carolina, Georgia and (? northern) Florida, westward through the Southern and Gulf States, into Louisiana, and probably eastern Texas.

General Characters.— Distinguished from *megalotis* and its subspecies by the clear white tips to the belly hairs, and the contrasted brown tips and blackish bases of the hair of the back; inner upper incisor bicuspidate.

Color.— Adults: the basal two thirds of the hairs of the dorsal surfaces is 'plumbeous black,' the terminal third a uniform cinnamon-brown, practically 'sayal brown,' in sharp contrast; beneath, the hairs are 'plumbeous black' basally, their tips *clear white*, again in sharp contrast. Specimens in thin pelage show much less of the cinnamon-brown above and the plumbeous bases of the hairs give a predominating dark appearance with a streaking of cinnamon; below, the white tipped hairs are less numerous particularly on throat and chest. The region at the posterior base of the ears is usually dark like the rest of the back, but in one specimen is whitish.

Immature individuals, though similar to adults in the contrasting dark bases and white tips of the hairs of the ventral surfaces, are much darker above, owing in part to the thinness of the pelage which allows the plumbeous bases of the hairs to show through, and in part to the paler (almost buffy) tipping of the contour hairs.

Skull.— Though essentially similar, the skull of *macrotis* differs from that of true *megalotis* and its race *pallescens* in being slightly smaller, and with a flatter profile. The intermaxillary notch is in general a trifle more contracted in dorsal view. The inner upper incisor of *macrotis* seems invariably to bear a small cusp on its exterior side, whereas in *megalotis* and *m. pallescens* this cusp is normally wanting, though in two out of twenty-eight specimens it was indicated, and in the race *mexicanus* is usually present.

Measurements.— No. 159413, Biol. Survey Coll., from Young Harris, Union County, Georgia: forearm 43.5 mm. (average of nine specimens 41.7); digit III, metacarpal 39.6 (average of nine 37.7); first phalanx 13.6 (average of nine 12.9); second phalanx 18 (average of nine 16.6); tibia 21.

Skull: greatest length 16.6 mm.; basal length 13.2; palatal length 7.3; zygomatic breadth —; interorbital constriction 4; mastoid breadth 9.5; width of braincase 8.5; upper tooth-row 6; lower tooth-row 7.

Remarks.— In its style of coloraton this bat differs notably from *megalotis* and its races, though in structure it is very similar. Its smaller skull, and the constantly bifid inner upper incisor distinguish it further from any of the forms occurring in the United States. I have found no evidence that it intergrades at any point with true *megalotis* or with *m. pallescens*. In North Carolina, a typical specimen in the collection of Mr. Morton L. Church, was captured at Marshall, in the extreme western end of the State, while from extreme western Virginia comes *megalotis*, without any sign of intergradation, though the localities are not far distant on opposite sides of the Alleghenies. Since writing the above, I have also examined a skin of *macrotis* from Mitchell, Ind., which is of interest as indicating not only the northward limit of the species' range in east central United States, but also that it keeps distinct from *megalotis* where the two occur together. Alcoholic specimens, if in good condition, show the white-tipped hair with its dark bases on the belly, and can usually be distinguished by this character. How far to the westward this bat ranges is as yet unknown. It is found in Louisiana and northward into Arkansas and Indiana but has not yet been discovered in eastern Texas although *pallescens* is recorded from western Texas. If this apparent hiatus shall prove to be real, it would indicate that the range of *macrotis* is fairly distinct from that of *megalotis* and its races. The present evidence therefore shows that *macrotis* constitutes a species distinct from the latter, though closely allied and of similar structure. It is characteristic of the Lower Austral life zone.

Specimens examined.— The following specimens have been studied, a total of nineteen.

North Carolina: Marshall, 1 (M. L. Church Coll.); ten miles northwest of Taylorsville, 2 (N. C. Coll. Agric.).
South Carolina: Society Hill, 2 (U. S. N. M.).
No locality, 2 (U. S. N. M.).
Georgia: Kesler, Early Co., 1 (M. C. Z.).
Young Harris, Union Co., 1 (Biol. Surv.).
? Riceboro, Liberty Co., 2 skulls (U. S. N. M.). These specimens were collected by LeConte, and though without record of locality, may have come from his plantation.
Alabama: Huntsville, 1 (Biol. Surv.).
Leighton, 1 (Biol. Surv.).
Louisiana: Houma, 4 (Biol. Surv.).
Arkansas: Osage River, 1 (M. C. Z.).
Indiana: Mitchell, 1 (Ind. Univ.).

In addition, it has been recorded from
Virginia: Dismal Swamp.

North Carolina: Bertie County; Goldsboro; Weaverville (Brimley, 1905, p. 22); Pisgah Forest, 3300 ft. (Oberholser, 1905, p. 9).
South Carolina: Hardeeville.
Florida: Micanopy.
Alabama: Greensboro.
Mississippi: Bay St. Louis.

CORYNORHINUS PHYLLOTIS, sp. nov.

Leaf-eared Bat.

Plecotus auritus J. A. Allen, Bull. M. C. Z., 1881, 8, p. 184 (not of Linné, 1758).

Type.— Skin and skull 5943, M. C. Z., collected by Dr. Edward Palmer, 24 March, 1878.

Type Locality.— Mexico: San Luis Potosi (probably near the city of the same name).

Distribution.— At present known from the type locality only.

General Characters.— Ears larger than in *megalotis*, the transverse ribs on the middle third of the outer edge subdividing and extending quite to the border; skull larger, the braincase inflated, and a distinct lachrymal ridge present; tips of hairs in sharp contrast with the dark bases; upper surface tawny olive; calcaneum with a well-developed keel.

Color.— Hair above long and silky; basal half dark, 'fuscous black,' the tips pale 'tawny olive'; a band of downy hair at the posterior base of the ears whitish. Below, the basal two thirds of the hairs is 'fuscous black,' the tips white, washed with 'pale ochraceous buff.' The distinct olive tone above is in marked contrast with the buffy or dark fur of the *macrotis* and *megalotis* coloration.

Skull.— This species is at once distinguished from the other species of the genus by its larger and differently shaped skull (Plate **1**, fig. 6). The braincase is flattened and broad, the rostrum broader and sharply depressed, with a more marked excavation medially; there is a distinct lachrymal ridge, as in Plecotus; the audital bullae are also larger. The teeth differ mainly in their stouter proportions, but the two upper incisors instead of being nearly side by side are one behind the other in the line of the tooth-row; there is also a greater disparity in size between the two anterior lower premolars, the first of which is much larger, in lateral view, than the second.

Measurements.— The type measures: forearm 44 mm.; digit III, metacarpal 42.4; first phalanx 14; second phalanx 16.3; digit IV, metacarpal 41.6; first phalanx 11.5; second phalanx 13.5; digit V, metacarpal 42; first phalanx 11; second phalanx 7; tibia 17; hind foot 10; ears (dry) from meatus 31; greatest breadth 21.

Skull: greatest length 17.5 mm.; basal length 14.9; palatal length 8.5; zygomatic breadth 10; interorbital constriction 4.8; mastoid breadth 10; width of braincase 9.6; upper tooth-row 7; lower tooth-row 7.1.

Remarks.— Though the type specimen was recorded thirty-five years ago, as *Plecotus auritus*, this remarkable species has remained till now unknown. The peculiar olive tone to the fur of the back is very different from the buffy or brown of the other known species. The very large and stiff ears are much like those of Antrozous, except for the breaking up of the transverse ribs at the middle of the outer margin. In this latter respect the ears recall those of Plecotus, in which also, the ribs run quite to the margin of the ear, instead of to a line parallel with the rim, as in other species of Corynorhinus. In Plecotus, however, the number of these ribs is about double that in *C. phyllotis*. The latter further resembles Plecotus in the possession of distinct lachrymal ridges on the skull, so that this character can no longer be considered of generic value in distinguishing between the two. A long narrow keel on the calcaneum is likewise diagnostic of this new bat, for in Plecotus as in other forms of Corynorhinus the calcaneum is without keel. In the squarish outline of the nostrils and the development of the excrescences on the muzzle it is typical of its genus. The peculiar bulging of the anterior part of the braincase is not seen in other members of this group. The tibia is proportionally shorter than in the smaller *C. megalotis mexicanus* which inhabits the same region.

Specimen examined.— The type.

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EXPLANATION OF THE PLATE.

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Fig. 1.— *Corynorhinus megalotis townsendii.* 150273 Biol. Surv., upper incisors and canine of right side, with supernumerary incisor (i^3).

Fig. 2.— *C. m. townsendii.* 204437 Biol. Surv. from McKenzie Bridge, Oregon, showing normal incisors (i^1, i^2) and canine.

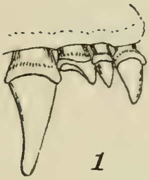
Fig. 3.— *C. m. mexicanus.* 98285 Biol. Surv. Type, to show bicuspidate first incisor and weak canine.

Fig. 4.— Ear of *C. megalotis.* 170933 Biol. Surv. from Sun City, Kansas.

Fig. 5.— Ear of *C. phyllotis.* 5943 M. C. Z. Type, from San Luis Potosi, Mexico.

Fig. 6.— Skull outline of *C. phyllotis.* 5943 M. C. Z. Type, from above.

Fig. 7.— Skull outline of *C. megalotis mexicanus.* 98285 Biol. Surv. Type.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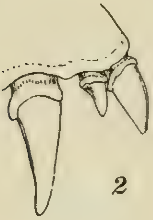
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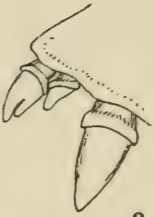
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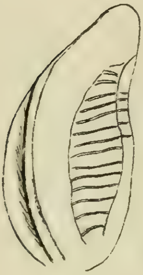
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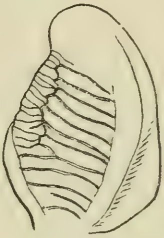
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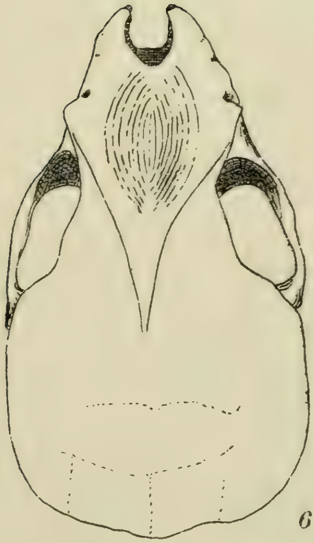
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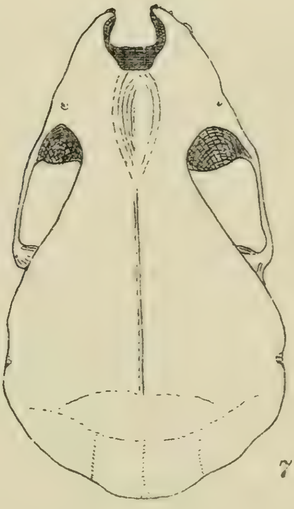
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THE RESIDENT BIRDS OF GUADELOUPE.

By G. K. Noble.

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No. 10.— *The Resident Birds of Guadeloupe.*

By G. K. Noble.

Introduction.

During the summer and early fall of 1914 I visited, in the interest of the Museum of Comparative Zoölogy, Guadeloupe in the French West Indies.

On the way and for the first few days while on Guadeloupe I was fortunate in having the company of Mr. F. R. Wulsin. We had several opportunities to make short ornithological excursions on some of the islands to the north of Guadeloupe. On the homeward voyage the ship was detained at St. Croix and several days were spent there in the field.

I remained on Guadeloupe from June 22nd to September 12th. In order to cover all the main regions of Guadeloupe and Grande Terre I spent four days or more in each of the following localities:— Pointe à Pitre, Goyave, Basse Terre, Ste. Claude, the Soufrière, Vieux Habitants, Cluny, Ste. Rose, Soffire, and St. François. My interest was chiefly in the land-birds and I was fortunate in finding all of the existing resident species.

Guadeloupe possesses a local museum, the Musée L'Herminier, in the town of Pointe à Pitre. Dr. F. L'Herminier was undoubtedly the greatest naturalist who ever lived on Guadeloupe; a student of the famous Blainville, he applied the best methods of his time to the study of Antillean bird life. Unfortunately in the great Pointe à Pitre fire of 1844, all his work on Guadeloupe birds was swept away. Lafresnaye (Rev. zool., 1844, p. 168) in describing some of L'Herminier's specimens comments briefly on this disaster:—

"Quoique nous eussions déjà ces trois espèces, que nous devions à l'obligeance de M. L'Herminier, avant l'affreuse catastrophe de la Pointe-à-Pitre, nous ne les avions pas publiées parce qu'il nous avait confié son projet de publier une Faune ornithologique de la Guadeloupe. Depuis lors, il nous y a autorisé, tout en nous apprenant que loin de renoncer à son projet, et malgré la perte immense pour lui de tous ses oiseaux, soit montés, soit dans l'alcool, de tous ses livres et de toutes ses notes, il s'occupe avec une nouvelle ardeur de le mettre à exécution."

A short time after the fire, the Musée L'Herminier was built. In 1876 Ober visited the island and remarked, (*cf.* Lawrence, Proc. U. S. N. M., 1878, **1**, p. 452):—

"Few birds are, as yet, in the museum but there are very excellent and complete collections of crustacea, etc., and many fine specimens of aboriginal implements."

I found the bird collection had so increased that it was larger than all of the other collections. Three well-mounted specimens of *Aestrelata diabolica* were included in it. Unfortunately most of the specimens were without data or records of their receipt.

I have omitted all reference to the birds noted at St. Croix except when they have direct bearing on the Guadeloupean birds. The West Indian avian fauna is rapidly being destroyed and for that reason it seems advisable to include here a complete record of the birds collected rather than to give simply an account of the more important studies, such as those relating to *Aestrelata haesitata, Cichlherminia herminieri,* and *Coereba dominicana.* Clark (Proc. Bost. soc. nat. hist., 1905, **32**, p. 203–312) has already summarized the general conditions of bird distribution in the Lesser Antilles.

TOPOGRAPHY.

Guadeloupe consists physiographically of two distinct parts:—Guadeloupe proper, a rugged mass of volcanic formation and Grande Terre, a flat limestone island separated from the former by a sluggish tidal water-way, La Rivière Salée. The adjacent islands of Désirade and Marie Galante are similar in structure to Grande Terre while the small archipelago called Les Saintes is volcanic like Guadeloupe proper. Guadeloupe and Grande Terre taken together are about forty miles in their greatest length and the same in their greatest width.

The whole surface of Guadeloupe is broken up into peaks and is cut by deep valleys making walking for any distance very difficult. Many of the hills reach to four thousand feet or over. The Soufrière for instance, is 4863 feet high. Its summit is wreathed with rain clouds throughout most of the year. The slopes on the mountainous core of this island exhibit many contrasts. There are at least four distinct life-zones:—

(1) Lowland savannahs. Great areas of grass-and scrub-land skirt

the coast of Guadeloupe and extend over the whole of Grande Terre. These regions are now for the most part under cane cultivation. A few swift flowing streams cross the plantations, but only the Grande Rivière in the north is navigable for more than a few hundred yards. The monotony of the grasslands is broken on the east coast by small stands of timber and on the west coast by broad outcrops of volcanic rocks. Marshes are rare in this belt and ponds even more so. On Grande Terre the soil is sandy and calcareous and the absence of water makes a hot and dusty landscape.

(2) Uplands of hardwood forest. The savannahs merge gradually into the uplands which are generally covered with medium sized deciduous trees. This belt varies in width from one to four miles and in several places such as at Ste. Marie, Ste. Rose, and Trois Rivières it encroaches through the grassland area and extends to the ocean.

(3) Rain forest. The dense tropical forest starts abruptly at about 1500 ft. and covers the greater part of the central region of Guadeloupe proper. It is almost impenetrable. While its bird fauna is characteristic, the number of species is small.

(4) Mountain barrens. Lastly the wind swept country above the tree line begins at about 4000 feet. It covers relatively a very small proportion of the island and is almost devoid of life.

The Vertebrate Fauna.

The vertebrates are represented in Guadeloupe by a very small number of species. An agouti (*Dasyprocta noblei* G. M. Allen), a racoon (*Procyon minor* Miller) and four or five species of bats comprise the entire indigenous mammalian fauna. The introduced Mongoose (*Mungos birmanicus* (Thomas)) is everywhere abundant and it is due to its depredations that the land vertebrates are so rapidly disappearing. The *Anolis ferreus* Cope is the commonest reptile. *Iguana delicatissima* Laurenti, and the Ground Lizard (*Ameiva cineracea* Barbour & Noble) are found today only on the small islands off the coast. A skink (*Mabuya maboia* Duméril & Bibron) may likewise have been completely extirpated from the mainland of Guadeloupe by the Mongoose. Two geckos, *Sphaerodactylus fantasticus* (Duméril & Bibron) and *Thecodactylus rapicaudus* (Houttuyn) because of their secretive habits are not commonly found, but they may be locally abundant. The two snakes, *Typhlops lumbricalis*

(Linné) and *Alsophis leucomelas* (Duméril & Bibron) formerly occurring on the island are now both extinct, but a species of Couleuvre (*Alsophis sanctorum* Barbour) closely related to the latter is peculiar to Les Saintes and is still found abundantly because the Mongoose has not been introduced into these islands. The Grenouille (*Eleutherodactylus martinicensis* Tschudi) and the introduced Crapaud (*Bufo marinus* Linné) are locally numerous on Guadeloupe. As in other Lesser Antilles the fresh-water fishes are few. The number of species of resident birds is noteworthy because the list is so short. Migrants are also few but deserve special mention.

Present Status of Bird Life.

There are three classes of birds which are not fully considered under the annotated list and which I shall discuss here: (1) extinct species, (2) probable resident birds, mostly water-birds, not collected during the trip, and (3) migratory species.

The parrots (*Ara guadeloupensis*, *Anodorhynchus purpurascens*, *Amazona violaceus*, and *Conurus labati*) were the earliest Guadeloupe land-birds to be completely exterminated. The old French accounts show that the natives killed them in numbers, but even so it is hardly possible that their annihilation was due wholly to human agency. *Fulica caribaea*, and *Rallus crepitans* have probably been extirpated by the Mongoose, at least they have not been taken by the native *chasseurs* for a long time. I saw at Cluny, on several occasions, a Mongoose far out in the middle of the swamp jumping from log to log in its eager hunting. The Diablotins, or Black-capped Petrels, have been extirpated from Guadeloupe, probably through several causes.

There are several birds not noted during my stay which may nest on Guadeloupe. The Black Hawk (*Urubitinga anthracina*) and the Chicken Hawk (*Buteo antillarum*) have both been observed by Pointe à Pitre sportsmen but it is doubtful if either of these were more than stragglers. I was informed that the Redstart (*Setophaga ruticilla*) occurred throughout the year but my own observations did not confirm this rather improbable statement. If the fishermen may be relied upon, the following sea-birds breed on the outlying islets of Les Saintes and Tête Anglais:— *Phaethon aethereus*, *Sula leucogastra*, *Sula piscator*, *Sterna maxima*, and *Anous stolidus*. The Yellow-crowned Night Heron (*Nyctanassa violacea*) breeds regularly just east of Ste. Rose.

There are many migrants which are either erratic wanderers or regular visitants and which pass over Guadeloupe, but the information regarding them is usually quite unreliable. The list of birds observed by L'Herminier (Proc. U. S. N. M., 1879, **1**, p. 450–451), between 1827 and 1844, is very large, and I doubt if some of the species recorded have been found on Guadeloupe in recent times. Winch (see Cory, Auk, 1891, **8**, p. 48–49) and Ober (see Lawrence, Proc. U. S. N. M., 1879, **1**, p. 452–462) both collected several of the migrants. Their lists, *plus* my own observations, include the following species which though not mentioned in the annotated list are nevertheless probably of regular occurrence:— *Sterna antillarum, Ereunetes pusillus, Pisobia minutilla, P. maculata, Actitis macularia, Helodromas solitarius, Aegialitis semipalmata, Ceryle alcyon, Seiurus noveboracensis, Wilsonia canadensis, Setophaga ruticilla.* Probably other species, chiefly herons and sea-birds visit the island as stragglers. I saw on July 22nd in a pond near Cluny a duck which I believe was *Dendrocygna discolor.* Many other species of ducks visit the island on migration. Mr. Delphin Duchamp, a prominent planter, informed me that the Ani (*Crotophaga ani*) and the White-crowned Pigeon (*Columba leucocephala*) have been occasionally seen on Guadeloupe after a hurricane. Other species very probably reach the island under similar circumstances.

ACKNOWLEDGEMENTS.

It gives me pleasure to acknowledge with many thanks the kind assistance of His Excellency, Monsieur Lauret, the Governor of Guadeloupe. Monsieur C. Thionville of his staff was also especially considerate. I am indebted to Monsieur D. Duchamp and Monsieur Riese for many favors while visiting their plantations.

During the preparation of this paper I have received assistance from Messrs. W. De W. Miller, John T. Nichols, and Charles H. Rogers of the American Museum of Natural History, who have examined specimens in that museum at my request; to the officers of the United States National Museum, the Philadelphia Academy of Natural Sciences, and the Field Museum of Natural History I am also indebted for their help in straightening out the status of *Tiaris bicolor omissa;* and I take great pleasure in thanking Mr. Outram Bangs and Dr. Thomas Barbour for explaining many technicalities of description and literature.

Annotated List of Species.

1. Podilymbus podiceps antillarum Bangs.

Chien d'eau.

One adult male from Cluny, near Ste. Rose, July 25th, and two young birds in the down, from the same locality, July 20th and 24th.

The series of Antillean Pied-billed Grebes in the Museum of Comparative Zoölogy is much too small to determine satisfactorily the status of this race. I do not believe the evidence brought forward by Todd (Ann. Carnegie mus., 1916, **10**, p. 170) is sufficient to consider that the Pied-billed Grebe breeds in the Antilles the same as the typical mainland form. Wetmore (Bull. 326, U. S. dept. agr., 1916, p. 17) has recently recognized *Podilymbus podiceps antillarum* as a valid race and I am inclined to regard it such until sufficient material has been brought together to allow an intensive study.

The Pied-billed Grebe still breeds on Guadeloupe although nearly extirpated by the Mongoose. Like the gallinules and rails, this species, formerly common, is now very rare. I found it breeding in only one locality, Grand Étang, Cluny. Several sportsmen of Pointe à Pitre told me that it only occurs in those lakes where there is an island to protect it from the stealthy approach of the Mongoose.

2. Frigata magnificens Mathews.

Mansfeny.

One adult male from Ste. Rose, July 21st.

The only Frigate-bird I succeeded in shooting was flying over a fresh-water pond and diving at intervals for fish. I saw many others off the coast. The fishermen told me that the Mansfeny breeds regularly on Tête Anglais.

3. Butorides virescens maculatus (Boddaert).

Qui-o. Crabier Vert tacheté.

One adult from Ste. Rose, July 20th, seven adult and half-grown specimens from Goyave, taken during the end of August; and six adult and half-grown birds from Les Saintes taken during the first week in September.

Oberholser (Proc. U. S. N. M., 1912, **42**, p. 529–577) has recently revised the subspecies of *Butorides virescens* and has described several new Antillean races. He refers the Guadeloupe bird to *B. v. cubanus* (Oberholser, *Loc. cit.*, p. 559–561) and erects another new race, *B. v. christophorensis* between the Guadeloupe bird and the northern race, *B. v. cubanus.*

I have compared a large series of specimens from nearly every island in the Antilles with the eighteen specimens taken on Guadeloupe and St. Croix and am convinced that the green herons from Cuba to Grenada all belong to one subspecies. Messrs. Bangs and Barbour have studied this series with me and have called my attention to the fact that the series from Guadeloupe includes within its range of variation, in color and measurements, the distinguishing characters of four of Oberholser's new subspecies:— namely, *B. v. christophorensis, B. v. dominicanus, B. v. lucianus,* and *B. v. grenadensis.* I saw in early July a green heron flying a considerable distance off the north shore of Guadeloupe and from the bird's position high in the air, both Antigua and Dominica must have been plainly visible. It seems very probable that green herons wander from island to island throughout the Greater and Lesser Antilles.

The Antillean race of green heron feeds in both fresh- and salt-water swamps but for some reason it is only locally abundant throughout Guadeloupe and Grande Terre. In general its habits are like those of our own Green Heron (*B. v. virescens*) except that the Antillean race has adapted itself to lizard hunting. On both St. Croix and Guadeloupe I have observed the green heron standing motionless in the center of a dry field watching for an Anolis. It is surprising to see this bird of the twilight and the swamps apparently dozing in the middle of an open field while the tropical sun glares down from directly overhead.

4. Cerchneis sparveria caribbaearum (Gmelin).

Gli-Gli.

Seven adults from various localities on Guadeloupe and Les Saintes: two from Ste. Rose July 13th, one from Ste. Claude June 26th, one from Goyave September 6th and three from Les Saintes September 15th.

The Sparrow Hawk is a common bird throughout the whole of the lowlands of both Guadeloupe and Grande Terre. It is the only resident hawk although several others occur as stragglers. In habits it resembles *Cerchneis sparverius sparverius* but seems more sluggish in flight. During the heat of the day it glides almost wearily over the plantations or dozes on some *palmiste* in the full glare of the sun.

5. Ionornis martinicus (Linné).

Poule d'eau à Cachet Vert.

One adult purchased at La Moule.

This specimen was taken sometime during 1913. It was the last Purple Gallinule that had been seen on Grande Terre. As with the rails, this species has probably disappeared from Guadeloupe because of the Mongoose.

6. Gallinula chloropus cachinnans Bangs.

Poule d'eau à Cachet Rouge.

Two adults, a male and a female from Grand Étang, Cluny, near Ste. Rose taken July 24th.

As already mentioned the gallinules are almost extinct in Guadeloupe. I do not believe there were more than three pair breeding in the Grand Étang. Bangs (Proc. N. E. zool. club, 1915, **5**, p. 93–99) has recently revised the American forms of *Gallinula chloropus* and has referred the Guadeloupe bird to the northern race. The measurements of the two specimens noted above are included in his revision.

7. Actitis macularia (Linné).

L'Alouette de Mer.

One adult, a female, from Ste. Rose, July 15th.

On the north shore of Guadeloupe near Ste. Rose I found the Spotted Sandpiper the first week in July. It is very likely that the species is a resident. The bird seeks out the lowland streams which are not too overgrown with foliage. In such regions it is common.

8. LARUS ATRICILLA ATRICILLA Linné.

Mauve à Tete Noir.

A few birds observed near Goyave, the latter part of August, but no specimens taken until September 16th at the island of St. Croix.

A comparison of a fair series of Laughing Gulls from the Lesser Antilles, Greater Antilles, and Bahamas with a large series from the mainland of North America shows conclusively that the island birds are smaller than the mainland ones. No color difference is apparent but the decided difference in size warrants the referring of the Laughing Gulls inhabiting the coast of North America, to a distinct race, which may be known as *Larus atricilla megalopterus* (Bruch).

Although there is some uncertainty as to the priority of this name, it seems most probable that Bruch (Journ. f. ornith., 1855, p. 287) was the first to describe the North American Laughing Gull. Linné's description was based upon Catesby (Nat. hist. Carol., 1733, **1**, p. 89) and Catesby only mentions the Bahaman bird. It seems probable that Bruch when describing *A. catesbyi* and *A. micropterus* was discussing the Bahaman bird. To be sure Bruch quotes Bonaparte as the authority for these names but when Bonaparte a year later (Comp. rend. Acad. sci., 1856, **42**, p. 771) published upon the birds he gave Bruch as the authority. In setting up Atricilla as a generic name Bruch was compelled by the custom of the time to use a new name for *Larus atricilla* Linné, to avoid duplicating names. *Atricilla catesbyi* refers, then, to the bird of Linné, in other words to the Bahaman-Antillean race. The next bird described by Bruch was *A. megalopterus* and although the description (Bruch, *Loc. cit.*, p. 287) is not good, he gives the type-locality as "Peru und der Mexicanische Meerbusen." It is at least conservative to refer this name to the North American race. The name *A. micropterus* cannot refer to this race because Bruch (*Ibid*, p. 287) gave it to a species smaller than *A. catesbyi*, in other words smaller than the Bahaman-Antillean race.

The difference in size between *L. a. atricilla* and *L. a. megalopterus* is shown in the following table.

Larus atricilla atricilla.

M. C. Z.	Sex	Locality	Wing	Tail	Exposed Culmen	Tarsus
14704	♂	Antigua	302	121	41	45
14699	♂	"	303	123	39	43
14702	♂	"	294	122	38.5	42
112927	♂	Union Isl.	301	116	37	41
112926	♂	" "	295	118	38	40
66611	♂	St. Croix	311	122	41.5	43
40181	♂	Bahamas	310	119	42	45
11842	♂	"	315	118	41.5	46
67424	♀	Cuba	303	116.5	38.5	42

Larus atricilla megalopterus.

M. C. Z.	Sex	Locality	Wing	Tail	Exposed Culmen	Tarsus
13832	♂	Florida	337	121	42	49
13839	♂	"	343	124	41	45
30571	♂	"	334	130	43	48
13837	♂	"	351	128	40	47
13836	♂	"	339	123	40	49
13834	♂	"	338	122	41	48
3169[1]	♂	"	348	131	43	50
30810	♂	New Jersey	349	131	42	48
3063[1]	♂	Georgia	337	125	42	49
42175	♂	"	356	132	40	46
3062[1]	♀	"	332	123	42	44.5
13835	♀	Florida	322.5	118.5	39	48.5
30691	♀	"	326	121	40	47

9. STERNA DOUGALLI DOUGALLI Montagu.

Petite Mauve.

One adult female from Les Saintes, September 10th.

The Roseate Tern is seen rather rarely about the coast of Guadeloupe, but on the outlying islands it is common. The species is reported by the natives to breed on Les Saintes to the south and on Tête Anglais to the north of Guadeloupe.

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[1] Coll. E. A. and O. Bangs.

10. STERNA FUSCATA FUSCATA Linné.

Mauve à Manteau Noir.

One adult female from Les Saintes, September 10th.

The fishermen report that this species also breeds on some of the outlying islets of Guadeloupe.

11. ANOUS STOLIDUS STOLIDUS (Linné).

Mwen. Noddi.

One adult male from Les Saintes, September 10th.

Like the Roseate and Sooty Terns, the Noddy is rarely seen about the mainland of Guadeloupe but is reported to breed on Les Saintes, Tête Anglais, and possibly elsewhere nearby.

12. AESTRELATA HAESITATA (Kuhl).

Diablotin.

One of the chief reasons of my visit to Guadeloupe was to obtain information about the Black-capped Petrels. A few days after landing I had the good fortune to meet Monsieur C. Thionville, President of the Club des Montagnards. The name Diablotin was associated in his mind with the past history and early colonization of the French in Guadeloupe. He immediately began to make inquiries about Basse Terre but without much success. Finally we made a trip together high up into the hills of Matouba to visit an old negro called Père Lownisky living on the slopes of the Soufrière. This old man in his early youth had often hunted Diablotins and had joined several of the large parties which had camped on the Nez Cassé to dig out the Diablotins from their burrows. Since Père Lownisky had spent his entire life in Matouba he knew all the old breeding grounds of the Black-capped Petrels. He told us that the Diablotins formerly bred on the north and northeast slope of Nez Cassé. The birds arrived in late September and the period of incubation for the colony as a whole extended through November and December. The young birds remained in the nest until March. He asserted positively, however, that no Diablotins had been heard or seen since the great earthquake of 1847. The old negro remembered that earthquake for during it the whole side of Nez Cassé, on which the Petrels bred, had collapsed and fallen into the valley. Père Lowinsky ended his exposition by dramatically raising his withered hand, exclaiming again in his "creole" French that the Diablotins had not been heard of for nearly seventy years,— "Jamais! — Jamais!"

A few days later I penetrated the "Grand Bois" as far as the old breeding grounds of the Diablotins. A sheer wall of basalt arose for several hundred feet finally losing itself in a bank of rain clouds. Very little vegetation clung to the steep sides of the cliff. My guides seemed to think it possible to scale the cliffs by the help of ropes. But remembering the old negro's statements in regard to the breeding season I did not make the attempt.

During the rest of my stay on the island I could get no more accurate information about the Diablotins. Several of the natives believed queer noises which they had heard nightly some years ago to be the call of the Diablotin.

The vast jungle covering the mountainous core of Guadeloupe is nearly impenetrable and entirely unexplored. While it is possible that a Black-capped Petrel may still breed on some isolated peak in the heart of Guadeloupe it is significant that not a single bird has actually been seen in the vicinity of the island in all these years.

13. AESTRELATA DIABOLICA (Lafresnaye).

Diablotin.

Upon my return to Cambridge I learned that the Lafresnaye collection (transferred from the Boston Society of Natural History to the Museum of Comparative Zoölogy) contained two cotypes of Lafresnaye's, *Procellaria diabolica*[1] and two other specimens of Black-capped Petrel somewhat similar to the cotypes but smaller. These specimens were all collected in Guadeloupe by L'Herminier in 1842. On the label of one of the smaller pair (Lafr. coll. No. 8003) the data reads Maupingue ou Maubingue, and on the other (Lafr. coll. No. 8004) Mauping ou Maupingue.

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[1] The third cotype (Lafr. No. 8001) was exchanged in 1886 with Prof. Alfred Newton for a specimen of the now extinct *Aestrelata jamaicensis* of Jamaica.

Lafresnaye (Rev. zool., 1844, p. 168) in his original description of *Procellaria diabolica*, referring to the larger specimens, says:—

"Une espèce de Petrel, le *Petrel Diable*, du père Labbat, Diablotin à la Guadeloupe, *Procellaria diabolica* L'Herminier, qui y arrive vers la fin de septembre, y niche en décembre dans les Falaises; une seconde espèce, en tout semblable de plumage à celle-ci, et n'en différant que par une taille moindre, y arrive à une autre époque, niche dans les mêmes falaises, mais à un étage différent en hauteur, ce qui les fait distinguer à la Guadeloupe par les noms de Petrels des hauts et Petrels des bas. Ces deux oiseaux seront pris pour la même espèce par tous les ornithologistes qui les posséderont sans renseignements sur leurs moeurs. Cependent M. L'Herminier les regarde comme constituant deux espèces bien distinctes, différant essentiellement de moeurs et d'epoque de passage. Mais n'anticipons pas sur les futurs documents que nous promet notre savant collègue, et qui auront un bien autre intérêt sous sa plume et racontés *de visu*."

The two pairs of Black-capped Petrels from the Lafresnaye collection are different from each other not only in size but in coloration and in shape of the nostril tubes. The smaller ones have the grey of the cap extending down the back of the neck and not terminating abruptly on the nape as in the larger birds, and the nostril tubes of the smaller birds are higher and end more abruptly than those of the larger specimens. In this respect as also in size the smaller birds are similar to *Aestrelata jamaicensis*. Each pair represents, I believe, a distinct species of Aestrelata.

Which species, then, is *Aestrelata haesitata*? This is a difficult question to decide because of the uncertainty of the original description. Kuhl (Beitrage zur zoologie, Frankfurt, A. M., 1820, p. 142) described a petrel "in Museo Bullokiano, nunc in Temminkiano" and calculated his measurements in terms of the "pollex."

If we assume that the pollex was the Frankfurt a. M. inch of that time, as determined by the Bureau of Standards at Washington and sent me by letter, it is then possible that Kuhl's specimen could be referable to either of the Guadeloupe species under consideration or better still to neither. Dr. Stejneger, however, recently told Mr. Bangs that Kuhl was a student of Temminck and would very likely have used the French system. Changing Kuhl's measurements from French inches (Ridgway, Nomenclature of colors, 1886, pl. 17 note) into millimeters and comparing them with the measurements of the Guadeloupe birds we find the figures more closely approximating the measurements of the small than of the large species. But still there is so great a discrepancy in the measurements, those of wing and tail being like the large bird, those of bill and tarsus like the small, that it is impossible to determine to which species Kuhl's specimen really should be referred. Since Lafresnaye described the large species as *Aestrelata diabolica* I prefer to restrict the name *Aestrelata haesitata* to the small Black-capped Petrel of Guadeloupe. The following table shows the difference in size between the two species.

Measurements in Millimeters.

	Wing	Tail	Bill to Angle of Mouth	Tarsus	Middle Toe (including Claw)	Culmen
Kuhl's specimen computed by Pied du Roi[1]	306.3	162.1	42.9	38.1	56.1	—
Kuhl's specimen computed by the Frankfurt a. M. inch[2]	268.71	142.26	37.54	33.58	49.39	—
Aestrelata diabolica M. C. Z. 73222	287	124	46.5	43	55	36
Aestrelata diabolica M. C. Z. 73221	288	135	46	42	55	35.5
Aestrelata haesitata M. C. Z. 73219	264	113.5	42	38	52	32.5
Aestrelata haesitata M. C. Z. 73220	276	116.5	41.5	37.5	51	33
Aestrelata jamaicensis M. C. Z. 73218	278	128.5	40	38	51.5	32

L'Herminier's list of Guadeloupe birds (*cf.* Lawrence, Proc. U. S. N. M., 1878, **1**, p. 451) includes both species of Guadeloupe Black-capped Petrels under the names *Procellaria diabolica* L'Herm. and *Procellaria mauping* L'Herm. These species are marked with a cross to indicate that L'Herminier also found them on Martinique. I have no other information in regard to the Black-capped Petrel in Martinique.

Investigation will probably show that *Aestrelata diabolica* and not *Aestrelata haesitata* as here restricted is the American Black-capped Petrel mostly represented in collections. Mr. J. T. Nichols has kindly furnished the following measurements of the specimens in the collections of the American Museum of Natural History and of Jonathan Dwight, Jr.

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[1] Ridgway, Nomenclature of colors, 1886, pl. 17 note.

[2] Determined by Bureau of standards.

Measurements in Millimeters.

	Wing	Tail	Tarsus	Culmen	Nostril Tubes	Remarks
Amer. Mus. 6212 Type of *P. meridionalis* Lawr. Florida Coast	293	133	35	32	Short ending abruptly	Sooty, not greyish above, crown scarcely marked off by lateral white from back
Amer. Mus. 46145 Long Island July 1850	—	—	35	35	Low ending gradually	Bill and foot only
Amer. Mus. 11212 ♂ Central Park Zoo. Jan. 8, 1912. CAPTIVE bird	277	143	38	31.5	Low ending gradually	Back grey, rump darker, nape broadly white marking off cap from back
Coll. J. D. Jr. Blacksburg, Montgomery Co., Va. Aug. 31, 1893, E. A. Smyth Jr.	290	146	35	32	Low	Nape whitish marking off cap from back. Cap and back sooty latter somewhat greyish
Coll. J. D. Jr. Cayuga Co., N. Y. Sept. 1893	290	143	37	35	Low	Back and cap sooty sharply marked off by white nape

It appears from this table that all of the birds in these collections except *P. meridionalis* Lawr. are referable to *Aestrelata diabolica* Lafresnaye. The actual measurements of Lawrence's type are somewhat larger than those considered typical *Aestrelata haesitata* as represented by the two specimens in the Museum of Comparative Zoölogy, but the characters of bill and coloration make it referable to that species.

I have included in the table the measurements of *Aestrelata jamaicensis* to bring out the similarity between that species and *Aestrelata haesitata.* It would be rash to consider *Aestrelata jamaicensis* simply a color phase of *Aestrelata haesitata.* Yet further study may reveal that these two species are very closely related.

During the course of my investigation of the status of *Aestrelata* *haesitata* and *Aestrelata diabolica* one more point came to light which may be of interest. Although Temminck (Pl. col., 1826, no. 416) wrote a brief description of *Aestrelata haesitata* he did not figure that species. His plate represents a petrel with grey upper tail-coverts similar to *Aestrelata cervicalis* Salvin.

14. COLUMBA SQUAMOSA Bonnaterre.

Ramier.

Seven specimens, adult and half-grown birds, from Ste. Claude, July 2nd, from Ste. Rose July 13th, and from Goyave, August 31st.

The Ramier is the principal game-bird of Guadeloupe. It is a bird of the rain forest and is found only high up on the "roof of the jungle." In the early morning and late afternoon scattered flocks dash by high over head making for their favorite feeding grounds among the taller fruit trees upon the mountain slopes. The native hunters learn to know these routes of daily migration and kill great numbers of the Ramier for market.

15. ZENAIDA ZENAIDA AURITA (Temminck & Knip).

Tourterelle.

One adult female from Goyave September 1st.

The Wood Dove is not rare in Guadeloupe but it is less abundant than *Geotrygon mystacea* in company with which it is sometimes found. But unlike the latter, it is widely spread over Guadeloupe and Grande Terre. It prefers the water's edge and is rarely met with in the mountains. In the open fields, especially those that are bordered with Mangrove swamps, the Tourterelle is common. This environment is very different from the hot, sandy hill-sides frequented by the closely related *Zenaida z. lucida* Noble (Proc. N. E. zool. club, 1915, **5**, p. 101–102) of St. Croix. The Tourterelle thrives well in captivity, and is perhaps the commonest cage-bird seen in Guadeloupe.

16. CHAEMEPELIA PASSERINA TROCHILA (Bonaparte).

Ortolan.

Twelve adult and half-grown specimens from Goyave, August 25th to September 1st.

On the east coast of Guadeloupe, in the lowlands of the north coast, and all over Grande Terre, the little Ground Dove is abundant. It is the commonest bird in the cane-fields, and in spite of its small size the natives snare great numbers for food.

Long after the young have been fully fledged, the parent birds stay with them. These family groups feed together about the edges of the cane-fields. While on the island I never saw an Ortolan that was not associated with its family flock.

17. GEOTRYGON MARTINICA (Linné).

Perdrix Rouge. Perdrix Gris.

One adult female from Goyave, August 20th.

Few of the *chasseurs* of Guadeloupe know that the Perdrix Rouge is the male and the Perdrix Gris the female of one and the same species, but all agree that both are nearly extirpated from the island. The habits of this species are similar to those of *Geotrygon mystacea* but unlike that species it seems to have been unable to adapt its habits to the introduced Mongoose. Today it is probably the rarest bird on Guadeloupe but fifteen or twenty years ago it was abundant and was considered excellent game.

18. GEOTRYGON MYSTACEA (Linné).

Perdrix Croissant.

Fifteen adults from Nez Cassé, Ste. Rose, and Goyave, taken late in June, in July, and August.

Since the introduction of the Mongoose all of the species of Perdrix have suffered because they build their nests near the ground and within easy reach of even a beast which is strictly terrestrial. But the Perdrix Croissant is still locally abundant in many of the mountainous parts of Guadeloupe. Like the other species, it is a rain forest bird, frequenting the dense wet undergrowths. The dense woods, however, form an easy approach for the Mongoose. But the Perdrix Croissant seems to be slowly adapting itself to new conditions. Towards evening small flocks fly down from the mountains to feed with the Tourterelles and Ortolans in the open clearings about the old cane-fields. My guides informed me that this habit had been recently acquired. It certainly helps to protect the birds from the stealthy approach of a Mongoose.

The Perdrix Croissant is ranked throughout Guadeloupe, as one of the best game-birds. The natives formerly caught them with hoops fitted with wire snares, and brought great numbers to market. During my stay on the island I never saw a single Perdrix sold in a village market.

19. COCCYZUS MINOR DOMINICAE Shelley.

Coucou Manioc. Oiseau de Pluie.

Four adults from Ste. Rose, July 13th–19th, six adult and half-grown specimens from Goyave, August 20th, September 1st.

I have compared a series of eight specimens from Dominica with eight adults from Guadeloupe and have not been able to find any appreciable difference between them. My Guadeloupe birds, in spite of the fact that they are in the worn summer plumage, seem to be a trifle darker than the Dominica birds and they also average slightly larger. But I prefer to regard this rather a tendency toward differentiation than a real racial distinction. The Guadeloupe birds measure: — wing 142.62; tail 163.69; exposed culmen 29.14; tarsus 29.74.

Locally distributed throughout the lower uplands of Guadeloupe, the Cuckoo is a conspicuous bird because of its slow and clumsy movements. It is confined to the low wooded hills, and not met with at all in the Mangrove swamps where I had been led to expect it.

The only cry I heard was a resonant guttural chuckle. On dull days this peculiar call is often heard in the hills. The natives believe the call to be a sure sign of heavy rain and hence they call the bird l'Oiseau de Pluie.

20. STREPTOCERYLE TORQUATA STICTIPENNIS (Lawrence).

Martin Pecheur. Pie.

One adult male from Goyave, August 27th.

The Martin Pecheur is found very locally distributed over the whole of Guadeloupe. It frequents the mountain torrents and pools, flying overland from one stream to another.

At Goyave I observed two Martin Pecheurs but was able to secure but one. At least one pair bred in the spring of 1914, in the high sand banks six miles up the Rivière de Goyave. The nesting hole resembled that of *Streptoceryle alcyon*, but was of course much larger.

21. SPEOTYTO GUADELOUPENSIS GUADELOUPENSIS Ridgway.

Coucou.

One adult specimen, which I was told came from Marie Galante, presented by the Musée L'Herminier. It now bears the catalogue number M. C. Z. 66347. The type of the species is M. C. Z. 74167.

The Burrowing Owl was formerly found on the cliffs of Marie Galante, but, since the introduction of the Mongoose some twenty years ago, it has completely disappeared. I could find no evidence of its ever having existed on Guadeloupe, Grande Terre, or Les Saintes.

The Musée L'Herminier had five well-mounted specimens of this species. Unfortunately they bore no data nor was there any record of their presentation to the Musée. The conservateur, however, assured me that they came from Marie Galante many years ago.

22. NEPHOECETES NIGER JAMAICENSIS (Ridgway).

Gros Martinet Noir. Hirondelle de Montagne.

Two adult males and one female from Goyave, September 1st.

It seems advisable to refer the Guadeloupe bird to this race, typical of Jamaica. No specimens from Haiti or Santo Domingo have been available for study. Both Ridgway's specimens from Guadeloupe (Bull. **50**, U. S. N. M., 1911, pt. 5, p. 706) and my series average slightly smaller than the Jamaican birds while the specimens from Dominica average larger.

Ridgway (*Loc. cit.*, p. 704) refers the Cuban bird to *N. niger niger*. The single specimen before me from Cuba, M. C. Z. 61113, is equally dark as the specimens from Jamaica and seems indistinguishable from them. It is included in the following table of measurements.

Measurements in Millimeters.

M. C. Z.	Locality	Sex	Wing	Tail	Exposed Culmen	Tarsus
61113	Cuba	♂	156	67.5	6.5	11.5
20446	Jamaica	♂(?)	151.5	66		11
20447	“	♂	162	63	6	11
62034	“	♂	154	67	6	11
20448	“	♂	153.5	60	5.5	11
21445	“	♀	151	60	6	11.5
13615	Dominica	♂	155	67	6	11.5
66334	Guadeloupe	♂	147.5	59	5.5	11
66333	“	♂	149	62.5	6	11
13615	“	♀	149	62.5	5.5	11

The Black Swift is especially abundant on the edges of the "Grand Bois." It was observed at nearly every locality visited except the flat land of Grande Terre. The bird is called L'hirondelle de Montagne by the natives because it appears just before sunset flying in great flocks from the mountains. I found it to be wholly an early morning and late afternoon flier. None of my guides knew anything of its breeding habits. But since the bird always comes from and retreats to the deep rain forest it is not improbable that it may roost in some of the big hollow trees on the mountain slopes.

23. Chaetura acuta (Gmelin).

Petit Martinet Noir. Hirondelle-Mouche.

Eleven specimens of both sexes from Goyave, August 29th and 30th.

The Lesser Antillean Swift was observed at only a few localities, first on July 4th at Ste. Claude flying with a number of Black

Swifts, and again on July 22d several were seen in an evening flight over Grand Étang, Deshaies. But at Goyave, August 29th the species was flying by day. Small flocks passed back and forth across a cow pasture throughout the heat of the day. These flocks remained in the same locality for several days and did not seem to be migratory. No flocks were observed in the evening, but scattered individuals were flying with the Black Swifts.

24. MELANERPES HERMINIERI (Lesson).

Tapeur.

Seven adults from Ste. Rose, July 16th–19th and eight adults from Goyave August 20th–September 1st.

Ridgway (Bull. **50**, U. S. N. M., 1914, pt. 4, p. 12) has created a monotypic genus for this species. The tendency to split up the Antillean woodpeckers into separate genera was carried further still by Miller (Bull. Amer. mus. nat. hist., 1915, **34**, p. 518) in his description of the Porto Rican form. There are, to be sure, some small differences between the Guadeloupe bird and any other species of Melanerpes, but I believe it is entirely a matter of individual opinion as to whether the Guadeloupe species should be separated from its mainland relatives and placed in a separate genus. It is perhaps worthy of note that in Antillean reptiles and amphibians we find most of the genera to be of wide distribution.

The Tapeur is certainly not a rare bird on the island but seems to be very local in distribution. It is confined to the hardwood belt covering the hills. Only once did I observe a woodpecker near a village. Then the bird was clinging to a half-decayed tree in front of the Gendarmerie at Ste. Rose.

The first time I became familiar with the Tapeur was in a sunny valley among the hills of Cluny. Every morning upon rising I would hear the roll of a woodpecker far away on some distant slope. Then a bird perhaps nearer at hand would answer until finally three or four would be rolling at once. Often they would call, or rather bray, and then the note reminded me of the warning cry of the Yellow-bellied Sapsucker (*Sphyrapicus varius varius*). There were many deserted nesting holes nearby, but none was lower than fifty feet from the ground.

In other parts of the island the species was less common, rare in fact on the west coast. Mr. Delphine Duchamp of Goyave believes the woodpecker had become more abundant about his plantation within the last ten years.

25. EULAMPIS JUGULARIS (Linné).

Gros-Colibri. Oiseau-Mouche à Gorge Rouge.

Four adults from the Soufrière June 26th–July 4th, and five adults from Ste. Rose July 8th–10th.

The Gros-Colibri is the commonest hummer on the island. It seems to prefer the higher altitudes. About the coffee plantations of Ste. Claude where the banana flowers were a further attraction this Red-throated Hummer is abundant. It likes to bask in the morning sun and often selects a roadside twig for a perch. The small boys set out straws smeared with gum on these perches and catch the bird as it alights. Like all of the island hummers this one is easily excited and comes readily to the "squeak." It then utters at short intervals a clear "seep."

On July 18th near Cluny I found a nest with its compliment of two eggs. The nest was larger than one of the Ruby-throat's (*Archilochus colubris*) but it was about the same in structure. The eggs were chalky white.

26. SERICOTES HOLOSERICEUS HOLOSERICEUS (Linné).

Colibri Bleu. Oiseau-Mouche Bleu.

Two adult males from Ste. Claude July 2nd and Goyave August 30th.

The Green-throated Hummer is the rarest of the three species of Colibri found in Guadeloupe. I observed it in the uplands associated with *Eulampis jugularis,* but never in the lowlands.

27. ORTHORHYNCUS EXILIS EXILIS (Gmelin).

Fou-Fou. Oiseau-Mouche huppé.

One pair of adults from the Soufrière, June 26th and 29th, and one adult male from Ste. Rose July 12th.

In the rain forest the tiny Fou-Fou is one of the few birds which one is sure to meet. It is often very pugnacious and on several occasions, when I have excited it by "squeaking" it has darted almost into my face. Although the Fou-Fou is the smallest bird on Guadeloupe it will drive away Sucriers, Gros-Becs, and even Grives from its favorite honey tree. In spite of its tiny size, it makes a great deal of noise during one of these attacks,— a crackling volley of psist! psist!! psist!!! loud enough to frighten even a man. The species is by far the noisiest of the Guadeloupe hummingbirds.

28. TYRANNUS DOMINICENSIS VORAX (Vieillot).

Pipiri.

Five adults from Ste. Rose July 12th, 14th, and one from Goyave September 2nd.

Ridgway (Bull. **50**, U. S. N. M., 1907, pt. 4, p. 708) states that *Tyrannus d. dominicensis* occurs in Guadeloupe. All of the six specimens, which I collected, are typical *Tyrannus d. vorax.* One, however, is smaller than the other Guadeloupian birds but larger than the average for the Greater Antilles. The occurrence of *Tyrannus d. vorax* in Guadeloupe is to be expected on zoögeographical grounds for the same race is found north as well as south of the island (*cf.* Riley, Smith. miscell. coll., Nov. 8, 1904, **47**, p. 2).

The Pipiri is perhaps the most conspicuous if not abundant bird of the lowlands. It resembles the Kingbird (*Tyrannus tyrannus*) in that it selects a high perch overlooking some bit of pasture and from these sallies forth after the passing flies. As it darts out the snap of its bill may be heard for some distance. Of all the bird notes about the cane-fields, the one that catches a stranger's ear first is the sharp *pip-piree, pip-pirr-ee* of this bird. In the early morning the bird is especially active and its call-note seems to arise from every corner of the plantation. I imagined the bird received its name from its call but Ballet (L'histoire de la flore, la faune etc. de la Guadeloupe, Basse Terre, 1895, **1**, 2, p. 21) says: — "Pipiri vient sans doute du mot breton pipirette, expression dont on se sert en Bretagne pour désigner l'aube ou piperette du jour."

29. MYIARCHUS OBERI OBERI Lawrence.

Pipiri Gros-Tete.

One immature male from Ste. Rose, July 11th.

The single specimen secured was one of the two birds of the species I saw on the island. The pair was observed in an area of deciduous scrub about four miles south of Ste. Rose. My guide, one of the best *chasseurs* of that village, said he had never seen the bird before on the island. The species was doubtfully recorded from Guadeloupe, and Ridgway (Bull. **50**, U. S. N. M., 1907, pt. 4, p. 618) questions Guadeloupe as a locality for it.

30. BLACICUS BRUNNEICAPILLUS Lawrence.

Gobe-Mouche Brun.

One adult male from the Soufrière June 29th and eight adults and half-grown specimens from Ste. Rose July 12th–16th.

I found the Brown Flycatcher not rare in Guadeloupe, but rather locally confined to the clearings in the deep woods. It seems to prefer the solitude of the forest, for it only comes into the open when hawking flies.

31. ELAINEA FLAVOGASTRA MARTINICA (Linné).

Petit Pintade. Gobe-Mouche huppé.

Not a rare bird in the woody parts of Guadeloupe. Two specimens, both sexes from Ste. Claude, July 3d; two birds, one female and one unsexed from Ste. Rose July 19th; and five specimens of both sexes from the Soufrière June 29th.

Near the highest part of the island visited, I took my first specimen of Petit Pintade. Then in the heavy cover about Ste. Claude, July 4th and near Morne Rouge, August 22d I observed several scattered flocks of a few individuals. In the lowlands where large berry producing trees are absent this species was rare.

Clark (Proc. Bost. soc. nat. hist., 1905, **32**, p. 208) has described the song at some length. Only on rare occasions did I hear the bird sing in Guadeloupe, and it was then a long clear whistle. In habits this bird is very like a wood-warbler reminding one particularly of a Black-poll (*Dendroica striata*).

32. HOLOQUISCALUS GUADELOUPENSIS (Lawrence).

Holoquiscalus martinicensis Ridgway.

Merle. Bout de Petun.

Nine specimens, adults and half-grown males from Ste. Rose, July 12th–18th; four specimens from Basse Terre, July 3d.

I fail to find any characters by which to separate *H. martinicensis* from *H. guadeloupensis*. Ridgway (Bull. U. S. N. M., 1902, **50**, pt. 2, p. 232) says of *H. guadeloupensis* "Similar to *H. martinicensis* but wing averaging slightly longer." His measurements for the wing of the male of *H. martinicensis* are: — 119.4–124 (120.7) and for the female 102.4–108.5 (105.4). For the male of *H. guadeloupensis*, on the other hand, his wing measurements are: — 119.9–124.5 (121.9), for the female 104.4–109.2 (106.7).

My averages for the wing of *H. guadeloupensis* are also slightly larger than those of *H. martinicensis*, but this difference is very small, and there is, apparently, no other distinguishing character. I do not believe a distinction can be made between the two forms, and it seems best to refer the Martinique bird to *H. guadeloupensis*. On geographical grounds alone there would seem to be a real difference between these two birds for the species has never been taken on Dominica, lying just between and in plain sight of Guadeloupe and Martinique. But if isolation has tended to make a distinction between the two forms, this distinction is, to my mind, at present not great enough to recognize two species.

Holoquiscalus martinicensis Ridgway.

M. C. Z.	Sex	Locality		Wing	Tail	Tarsus	Exposed Culmen
10895[1]	♂	Martinique,	F. W. I.	120.5	96	36	27.5
27688	♂	"	"	118+	100+	35.5	27
28696	♂	"	"	120	102	38–	28
28695	♀	"	"	108–	87	34	24
11272	♀	"	"	105	85	33	24
11273	♀	"	"	104+	80	37–	25

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[1] Coll. E. A. and O. Bangs.

Holoquiscalus guadeloupensis (Lawrence).

M. C. Z.	Sex	Locality		Wing	Tail	Tarsus	Expssed Culmen
66571	♂	Guadeloupe, F. W. I.		123.5	104–	36	28
66570	♂	"	"	119	100	35	29
66571	♂	"	"	121	102.5	35	27.5
66572	♂	"	"	120+	102+	37.5	27
66566	♀	"	"	104.5	80	31.5	21+
66567	♀	"	"	107.5	88	31	25.5
66568	♀	"	"	106	80	32	21+
66578	♀	"	"	105.5	83	30	24
14853	♀	"	"	——	81	32–	24–

Although the Merle never ascends to any of the high pastures at the edge of the rain forest, it is still fairly abundant over the rest of the island. I did not meet with it at all during my stay at Ste. Claude, Vieux Habitants, Morne Rouge, or any of the other high regions I visited. But about the low plantations of Ste. Marie and Goyave it was very abundant. At Ste. Rose from July 12th–20th the Merle was seen nearly every morning in the Mango trees surrounding a large cow pasture. In fact wherever herds of cattle are grazing one may feel certain of seeing or hearing some Merles providing the altitude is not too great.

Ballet (*Loc. cit.*, p. 23) in speaking of the Merle says:—

"Cet oiseau vit par bandes nombreuses, aime à se percher sur les grands arbres, notamment sur les palmistes, se perche sur les boeufs pour dévorer les tiques et autres vermines dont ils sont couverts, est très famillier, suit le laboureur, et, posé sur les boeufs, ou la charrue, se précipite sur les larves et les insectes mis à découvert par cet instrument aratoire. Sa chair n'est pas bonne. Aussi, grâce à son peu de goût, il a échappé à la destruction et rend à notre agriculture d'immenses services. Ses bandes multipliées couvrent la Grande-Terre et une partie de la Guadeloupe."

The notes of the Merle are as varied as those of the Starling (*Sturnus vulgaris*). When in flocks the Merle keeps up an incessant jabbering. Sometimes, especially in the early morning, the bird gives its true call-note, a double whistle of two syllables, the second rather prolonged. But it is the conversational jabbering which is most characteristic of the bird.

33. PYRRHULAGRA NOCTIS DOMINICANA Ridgway.

Père Noir. Gros-Bec.

Thirteen specimens, adults and half-grown, of both sexes from Ste. Claude July 3, and from Ste. Rose July 15th, 16th, and 20th.

When we consider the tendency of Pyrrhulagra to break up into island races in the Lesser Antilles, we might readily expect the Guadeloupe bird to be distinct. This series, however, is much too small to distinguish the Guadeloupe from the Dominica bird. My measurements fall within the limits shown by Ridgway's specimens (Bull. 50, U. S. N. M., 1901, pt. 2, p. 556).

The Père Noir is the common sparrow from the high woods to the mangroves. It is the only bird that is evenly distributed over the whole of Guadeloupe. Several of these birds were seen June 27th–29th at the "Club des Montagnards" near the crest of the Soufrière, others July 1st–4th about Ste. Claude, and then on July 20th it was seen again in equal abundance in the mangrove swamps about Ste. Rose. The natives apply the name Gros-Bec to both sexes while they reserve the name Père Noir for the male. The birds are often found in flocks in the dooryards of the houses. Its sharp chirp and clear song, pseep! pseep!! pseep!!! are characteristic sounds of the country villages.

34. TIARIS BICOLOR OMISSA (Jardine).

Olive. Mangeur d'herbes.

Two adults, male and female from Goyave, September 5th and 7th.

The grassquits of Grenada, the Grenadines, St. Vincent, and Barbados instead of being referable on Grenada and Barbados to *T. b. marchii*, and on the other islands to the more wide-spread *T. b. omissa* as believed by Ridgway (Bull. 50, U. S. N. M., 1901, pt. 1, p. 538, 541) really represent a well-defined race which is apparently confined to these southern islands of the Lesser Antilles. It may be distinguished at once from the two races mentioned by its different size and coloration, and it may be known as

Tiaris bicolor expectata, subsp. nov.

TYPE: M. C. Z. No. 13109, (E. A. & O. Bangs Coll.) from St. George, Grenada, June 19, 1904, Austin H. Clark. In measurements it is smaller than *T. b. marchii.* The average of 14 males, and 9 females from Grenada and Grenadine, 4 males and 2 females from St. Vincent, and 6 males and 4 females from Barbados,— 39 specimens in all are:— wing 51.3 (48–52.5); tail 38.2 (36–40); exposed culmen 9.1 (8.5–9.5); depth of bill 7.4 (7–8); tarsus 17.3 (15.5–18). While on the other hand a series of 39 specimens, 26 males and 13 females from Jamaica, representing *T. b. marchii*, the average is:— wing 52.4 (50–54.5); tail 40.6 (38.5–42.5); exposed culmen 8.9 (8.5–9.5); depth of bill 6.8 (6.5–7.5); tarsus 17.1 (16.5–17.5).

In coloration it differs widely from *T. b. marchii* in that the dark area of the breast is not sharply divided, but merges gradually into the white of the belly-region with often scattered spots in blotches of darker color, extending posteriorly along the sides of the belly and encroaching considerably into the white area.

It is similar to *T. b. omissa* but has a longer tail and different coloration. Clark (Proc. Bost. soc. nat. hist., **32**, p. 286) considers both the Grassquit from Grenada and St. Vincent as referable to *T. b. omissa.* The series of skins before me, however, show that grassquits from Grenada, the Gernadines, Barbados, and St. Vincent differ from those of the other islands of the Lesser Antilles by having more white on the belly. The tails of the former birds are relatively longer averaging 38.2 against 37.1 of those of the latter. These characters are rather constant throughout and are sufficient, I believe, to distinguish separate geographical races.

I have examined a series of twenty-seven skins from other islands of the Lesser Antilles but fail to find any characters upon which to separate the bird occurring on the islands from St. Lucia to Porto Rico from the mainland specimens. It seems anomalous to find *T. b. omissa* in Tobago and Venezuela and then skipping Grenada, the Grenadines, and St. Vincent occurring again on the other islands of the Lesser Antilles. But until a larger series of skins can be examined it is perhaps premature to cite this as a case of convergent evolution.

Ridgway (Bull. 50, U. S. N. M., 1901, pt. 1, p. 539) records two specimens of *T. b. omissa* taken in Cuba. Since there are no other Cuban records I inquired into their authenticity. Mr. C. B. Cory, of the Field Museum, informed me by letter that the birds were given to him by Gundlach and Cory supposed that they came from Cuba. Like so many other of Gundlach's birds they were probably collected during one of Gundlach's three trips to Porto Rico. The Grassquit is not so abundant on Guadeloupe as in the northern Lesser Antilles. On Guadeloupe it is confined to the lowlands where it prefers the hot road-sides. The bird is rather shy and upon approach it disappears quickly into the nearest thicket. Its monotonous call has something of the buzz of a locust and something of the call of the Sucrier in it.

35. SALTATOR ALBICOLLIS Vieillot.

Grive-Gros-Bec.

Twelve specimens, adults and half-grown from Ste. Rose July 12th to 16th; and from Goyave August 20th to September 4th.

I never met with the Grive-Gros-Bec during my stay on the west coast, but in the north and east of Guadeloupe I found that the bird was not rare. It usually frequents the small stands of hardwood on the mountain slopes. In the rain forest or about the plantations it was less often seen.

This species is the "Grive" most frequently shot. It is ranked as a game-bird in spite of its laborious movements. Its low chuckle, its stealthy but nevertheless clumsy approach by hopping from twig to twig and finally its loud whistle are all very characteristic. In flight and general habits the Grive-Gros-Bec reminds one most of a very young and awkward Pine Grosbeak (*Pinicolor enucleator leucura*).

36. EUPHONIA FLAVIFRONS FLAVIFRONS (Sparrman).

Perrouche. Perrique de Matouba.

Four adults, three females and one male, from the slopes of the Soufrière near Matouba taken June 28th.

The Mistletoe bird is confined to the steep and heavily wooded slopes of the interior. It feeds in flocks on soft fruits and berries. All four of the specimens taken had their crops stuffed with gelatinous coated fruit-seeds. The plaintive whistle of the Perouche is often heard in the deep, vine-covered gorges of the Soufrière but because of the bird's small size and its retiring habits one rarely catches a glimpse of this, the most beautiful of Guadeloupe birds. In fact the natives believe that at certain seasons of the year when the wild fruit is ripe, flocks of these tanagers fly over from Dominica. It seems more likely, however, that they had previously overlooked the bird.

37. PROGNE DOMINICENSIS (Gmelin).

Hirondelle de Dominique.

Six specimens of both sexes from Goyave, August 30th and 31st This species is not rare about the low plantations of the east coast of Guadeloupe and of Grande Terre. The first bird I saw upon reaching Guadeloupe, June 22d, was a martin flying about the stern of the vessel. A flock seemed not only in color but in flight like great tree-swallows hovering overhead. On the west coast the bird was exceedingly rare and it was not until I had taken up my abode at Goyave that I really became acquainted with it. On warm moist evenings, so characteristic of the Windward Islands, widely scattered flocks of *Progne dominicensis* and *Nephoecetes niger jamaicensis* would appear and skim over the cane-fields. During the heat of the day neither of these birds is visible. In the early morning especially along the waterfront I found this Martin rather abundant.

38. VIREOSYLVA CALIDRIS BARBADENSIS Ridgway.

Siffleur.

Five specimens from Goyave and the Soufrière taken the first week in July and the last week in August.

When passing through the patches of hardwood trees that skirt the deep forests one is sure to hear the whistle of this bird coming from the top of some lofty forest giant, and even among the scrubby growths of the lowlands one may often hear that same clear note. In writing of this bird Ballet (*Loc. cit.*, p. 22) says: —

"On lui a donné ce nom, parce qu'il imite parfaitement le sifflet de la voix humaine. Il se tient dans les bois. On croit toujours quand on l'entend que c'est un homme qui en appelle un autre. Il n'y a point d'etranger qui n'y soit trompé."

This bird resembles the Red-eyed Vireo not only in its choice of a home but also in its actions, in its song, and its nest building.

39. Coereba dominicana (Taylor).

Sucrier.

Common in the cultivated regions. Ten specimens from the plantations about Ste. Claude and Ste. Rose.

I have examined a series of five adults of this species from Guadeloupe, four from Antigua and five from Dominica, and I find a considerable variation in both color and size. In adults from the same island the breast and belly varies from yellow-green to bright ochraceous while the upper parts differ considerably in their intensities. The specimens from Antigua have a constantly shorter tarsus, it averaging 17.2 mm. against 18.2 for those of Guadeloupe and 18.4 for those of Dominica. The other measurements are all within the limits of individual variation.

The white wing-spot does not seem to be a good specific character. In two of the specimens from Antigua, one from Guadeloupe, and two from Dominica this mark is just visible. Upon examining a series of nine adults from St. Croix and another of nineteen adults from Grenada and Grenadines I fail to find that the characters given by Ridgway (Bull. 50, U. S. N. M., 1902, pt. 2, p. 400) in his key hold true. Instead of *C. saccharina* having a smaller wing-spot than *C. newtoni*, it has in every case at least as large if not a larger one. Again, the superciliary stripes of the latter are not broader than those of the former, rarely, however, they come closer together on the head (2 specimens) and spread out so as to touch each other. *C. newtoni* may, however, generally be distinguished from *C. saccharina* by its lighter color, especially on the breast and throat, and again by its shorter tarsus averaging 18.3 mm. (fourteen specimens) against 19.1 for the latter.

Everywhere in the lowlands and as far up the mountain as the Grand Bois extends, the Honey Creeper is abundant. About the banana plantations I found them in greatest numbers, often nesting in the vicinity of the houses. When examining a flower this species is as acrobatic and agile as a nuthatch, while its undulating flight is much more graceful. The song is a characteristic little wheeze,— Zee! — Zee! Because of its great curiosity the Honey Creeper is often killed by the small boys. All the country gamins know how to "squeak up" this little bird into range of their blow-pipes or they can, at least, catch them by means of straws smeared with bird-lime.

40. Dendroica plumbea Lawrence.

Fauvette Grise.

Ten specimens, adult and half-grown, taken on the slopes of the Soufrière in the vicinity of, and above Ste. Claude, during the latter part of June and the early part of July.

The avifaunas of Guadeloupe and Dominica are by no means identical, nevertheless many of the small birds are the same on both islands. I have examined a large series of adults and young and find that this species does not differ in the two localities.

Adults from Dominica.

M. C. Z.	Sex	Wing	Tail	Exposed Culmen	Tarsus
60950	♀	61.5	49.5	10	21.2
13569	♀	61.8	51	10.5	21.2
13610	♀ (?)	64.5	52	10.5	21.5
28767	♂	60	51.5	10.5	20.5
28766	♂	60	50.5	10.2	20.5
13570	♂	67	56	11	22

Adults from Guadeloupe.

	Sex	Wing	Tail	Exposed Culmen	Tarsus
	♀	60.2	53.5	10.2	20.5
(albinistic)	♀	59.8	49	10.5	20
	♂	63	51	10	20.2
	♂	63.5	51.5	10.2	19.8
	♂	62.5	51.5	10.8	19.8
	♂	63.5	50.5	10.8	20.5
	♂	67	55.5	10.5	21.5

I never met this bird anywhere but in the deep woods. It is a true wood-warbler and as such does not descend into the lowlands unless following some extension of the forest. In the dense dripping woods that cover the sides of the Soufrière, it is often met with and is always one of the first birds to answer to the "squeak." At Ste. Rose where the heavy woods of Soffire are so near at hand, this little warbler may be found just outside of the town.

Camping near the top of the Soufrière, I found the bird common about the mountain streams. Near the base of the huge mass of denuded lava which forms the summit of this volcano, an albino female was taken. The head and neck are white, a series of white blotches extend down the back and sides while the rest of the plumage is the normal olive-grey.

41. DENDROICA RUFICAPILLA RUFICAPILLA (Gmelin).

Oiseau Jaune.

A common species in the lowlands. Fifteen specimens from immediate neighborhood of Goyave, Ste. Rose, and Ste. Claude taken on various days throughout July and August.

Clark (Proc. Bost. soc. nat. hist., 1905, **32**, p. 294) says "The subspecies of this form, *D. r. ruficapilla* (Guadeloupe and Dominica), *D. r. rufivertex* (Cozumel Island), *D. r. flavida* (St. Andrew's) and *D. r. rufopileata* (Curaçao) appear all to fall within the range of individual variation, if we can judge from the great differences exhibited by a series of sixteen specimens of the closely related *D. capitalis* of Barbados. The only specimen from Cozumel Island which I have been able to examine, as well as three specimens from Dominica * * * are inseparable from Grenadine examples." An examination of a large series of this species including the specimens taken by Mr. Clark as well as those collected by myself shows that the distinguishing characters of the described races have no more value than Clark gave them. It is clear that only one form should be recognized.

Among the mangroves, about the plantations and ascending the sparsely wooded hills this bird is common. Ober says of it (Proc. U. S. N. M., 1878, **1**, p. 453) "with the two sparrows the bird is most commonly met with in the gardens and coffee plantations. In the latter, I find it chiefly in the pois douce trees, which, originally planted as wind-breaks for the coffee plants' protection, seam the hills all around in long rows." About Goyave and Ste. Rose I found it most common in the small plantations bordering the mangroves. It sometimes occurs in numbers upon the high uplands, but I have never taken it higher than Ste. Claude some two thousand feet above the sea. Its habits, nesting, and song are all very much like those of the Yellow Warbler (*D. aestiva aestiva*) but unlike this species it seems to prefer the hot scrubby fields to the streams and swamps, although some are always to be found about the mangroves.

42. TROGLODYTES GUADELOUPENSIS (Cory).

Rossignol.

One adult female taken July 13th, near Ste. Rose.

This species is now practically extinct owing to the Mongoose. Twenty-five years ago the bird was widely distributed all over the island, and like the House Wren would frequent the gardens about the villages. For more than ten years it has been extremely rare and local, found only in the high woods which have been more or less cut over. Although I visited over a dozen distinct localities on Guadeloupe it was only seen on the wooded hills back of Ste. Rose.

It was in the evening, shortly after the sun had set that I heard for the first time the song of this wren. It was long and varied with more of a warbler quality than that of a wren. But the profusion and bubbling merriment of the song could be given only by a wren. As I advanced through the brush, the bird darted off to a fallen log, ran nimbly along it, hopped into a low tree and began to flit upwards from one branch to the next till it had reached the top. Then it flew off to another tree to again start its spiral climb upwards. When finally shot it proved to be a female, and although unsuspected until the specimen was dissected I had probably been following a pair of wrens and not a single individual.

43. CINCLOCERTHIA RUFICAUDA TREMULA (Lafresnaye).

Trembleur. Grive Trombleuse.

Eight specimens, adults and half-grown individuals, taken throughout July and the latter part of August from the Soufrière, Ste. Rose, and Goyave.

Confined entirely to the deep woods, this bird is one of the few species one meets while struggling through the forest. When flushed from the ground where it is habitually to be found, it flits up to a low branch and begins to shake as if in the grasp of a tropical fever. At the same time it jerks the tail nervously up and down just as a Spotted Sandpiper does, accompanying these movements by a bobbing of its head in every direction. My guides said that the small heaps of snail-shells quite often found upon the forest-floor were made by this bird which feeds almost entirely upon the snails. The species is so rare and local that I was unable to verify this assertion.

The Mongoose, now found in every part of the island, has almost exterminated it. The greater part of my time on the island was spent in the deep woods where only a few were found. If one moves very quietly to a suitable place for "squeaking" this bird may be easily induced to come within gunshot, but I have never heard it utter any answering call except and only rarely a low guttural sound. The coloration and actions of this bird are in keeping with its environment. Its uniform dark plumage makes it invisible among the dark, decaying leaves of the forest-floor, while its silent flitting to and fro are in harmony with the great hush of a tropical jungle. The peculiar trembling habit is probably some sort of a warning motion, but during this action the bird is not very unlike a bunch of dried leaves shaking in the wind.

44. Cichlherminia herminieri (Lafresnaye).

Cichlherminia coryi Ridgway.

Grive à Pieds Jaunes.

Twenty-four specimens from the region about Ste. Rose and Goyave taken during the latter part of July and August.

This series of specimens together with Lafresnaye's and Ridgway's types make it clear that *Cichlherminia coryi* Ridgway (Smiths. misc. coll., 1904, **47**, p. 112) is the adult of *Cichlherminia herminieri* (Lafr.). These specimens show a gradual change from one to the other kind of plumage, a change which is undoubtedly one of age. Lafresnaye's original labels for the types of these two species show that all the birds came from Guadeloupe. The specimens were sent to Lafresnaye by Dr. F. L'Herminier in 1844, and are now together with their original labels in the M. C. Z.

Ober (Proc. U. S. N. M., 1878, **1**, p. 452) in his field-notes on this bird writes: —

"A resident of the wooded hills and mountains; found in Dominica in the same localities as the Perdrix, woods sufficiently free from underbrush to afford places for scratching. The places where they have disturbed the earth by scratching are frequently seen in the paths, where the woods are thick, and in the open forest. They will come quickly at the *call* if within hearing, but are shy, flying cautiously from tree to tree never long at rest."

According to my experience they are extremely local requiring a thick wet forest but not one so thick as the rain forest of the high ranges. In Guadeloupe this species is practically unknown on the west coast. To the north of the island it is only back in the hills of Bellevue that the bird is found. In the south and east I found it not rare about the foothills of Morne Rouge, near Goyave, and again at Ste. Marie.

As Ober has said this species is a ground inhabiting bird. For this reason it was one of the first victims of the Mongoose. Since as Ballet (L'histoire de la flore, la faune etc. de la Guadeloupe — Basse Terre 1895) expresses it "la chair est la plus tendre et la plus delicate," the natives for many years have set out great hoops each with sixty to a hundred snares attached. The bird while scratching would become entangled and would eventually be found and taken to market where it would be sold for five cents. Now everything is changed, the Mongoose has nearly exterminated the species while those few individuals that remain seem to have adapted themselves to the new conditions, and if one can believe in hear-say are on the increase. This change is probably a forsaking of the ground for the low dense shrubbery. I did not once surprise the bird scratching among the leaves. Often I have heard its bell-like note coming from high up in the trees. It is a very characteristic call, mellow, resonant, and repeated at frequent intervals.

45. Allenia apicalis (Hartlaub).

Grive Fine. Grive Cendree.

Thirteen specimens from five different localities on Guadeloupe, taken during both July and August. This species is not rare wherever the environment is suitable.

An examination of a large series of specimens from the islands of the southern Lesser Antilles shows a tendency for this species to become darker in color as it progresses southward. This difference does not seem to be seasonal or sexual. Between any two adjacent islands there is no marked difference in color, but the birds from Barbados and Grenada are distinctly darker than those from Guadeloupe. Because of this intergrading, it seems hardly advisable to draw a line between the northern and southern birds by separating a race.

J. H. Riley (Smith. misc. coll., 1904, **47**, p. 288) has noted this slight difference and in speaking of the Barbuda and Antigua birds says: —

"The above series, when compared with a series from the other Lesser Antilles, averages more olive brown above, without the reddish cast in the plumage seen in the other series before me. The measurements are also slightly larger as the following will show: Four males from Barbuda and Antigua average: wing, 129; tail, 104.6, culmen, 20. Seven males from Saba south to St. Vincent average: wing, 121.3; tail, 95.6; culmen, 19.4."

I find the Guadeloupe bird compares favorably in measurements with the Barbuda-Antigua birds. Three males from Guadeloupe average: — wing, 121.3; tail, 93.6; exposed culmen, 18.3; tarsus, 29.2. Three females from Guadeloupe average: — wing, 124.9; tail, 98; exposed culmen, 18.8; tarsus, 31.

The measurements of the Dominica birds, on the other hand, fall well within the range of variation in a series of twenty birds from the islands to the south as far as Grenada. Three males from Dominica average: — wing, 114.6; tail, 90.5; exposed culmen, 18.8; tarsus, 28.3. It seems evident then that if a southern race were to be separated from a northern the Guadeloupe bird would be included in the northern and the Dominica bird in the southern. Such a splitting up of races on these two closely associated islands is not at all the rule of subspecific differentiation in the avifauna of the Lesser Antilles. On Guadeloupe this species is the commonest of the three Grives, but I did not meet with it at all during my short stay on some of the more northern islands. It prefers the borders of woodlands made up of pure stands of deciduous trees or again the scrubby upland fields; still it is not rare even in the deep woods wherever there is a clearing formed by a tree which has crashed down.

The song of this bird consists of a few high notes uttered slowly and deliberately, generally from the top of some small tree standing at the edge of a clearing. The birds congregate only when feeding on the small fruit-trees, and it is rare that you find them together.

46. MARGAROPS FUSCATUS DENSIROSTRIS (Vieillot).

Grosse Grive. Grise Corossol.

Eleven specimens from the deep woods near Ste. Rose, the Soufrière, and Goyave taken in the latter part of July and the latter part of August.

Few birds of Guadeloupe are more strictly confined to the deep woods than this species. Very shy and retiring in habits it seeks the tallest trees of the rain forest. On my homeward voyage from Guadeloupe I was greatly surprised to find the closely related *Margarops f. fuscatus* in the streets of Christiansted, St. Croix; for I associated such a bird with anything but the noise and bustle of traffic. Perhaps the lighter color of this form to the north has been brought about by its open and sunny habitat.

The Grosse Grive is considered throughout Guadeloupe as one of the best game-birds to be ranked even with the Ramier and Perdrix; and since it lives on the roof of the tropical forest covering the higher parts of the island, the hunters are put to considerable trouble to obtain it. When disturbed the bird utters a sharp cluck, entirely different from the alarm-note of any other bird of the region. The cluck is repeated at intervals and is accompanied by a simultaneous lowering and jerking upwards of the tail. The bird's song is loud and clear consisting of a series of long whistles. In attracting this Grive, the natives give a long call of low vibrant sounds,— shush! shush! — not unlike the puffing of a distant locomotive. They explain this call as the imitation of a mother Grive hovering over a young one which has fallen from the nest or been overtaken by some other calamity.

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THE STANFORD EXPEDITION TO BRAZIL, 1911, JOHN C. BRANNER, DIRECTOR. THE ANTS OF BRAZIL.

By William M. Mann.

With Seven Plates.

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No. 11.— *The Stanford Expedition to Brazil, 1911. John C. Branner, Director. The Ants of Brazil.*

Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 114.

By William M. Mann.

As Entomologist to the Stanford Expedition, it was my privilege to spend the summer and fall of 1911 making collections in various parts of Brazil. Natal and Ceará on the East Coast were our headquarters for the first three months, and from these stations side trips were made to nearby points. In the early part of July, when the other members of the party returned to the States, Dr. Fred Baker and I remained at Pará, and subsequently went up the Amazon to Manaos. We hoped to be able to get into the region of the upper Rio Madeira. Our hopes were more than realized, for Mr. May, senior member of the firm, May, Jeckyll & Randolph, then engaged in constructing the Madeira-Mamoré Railroad, took an active interest in our work and provided us with transportation from Manaos to Porto Velho on the little steamer owned by the company, and with letters to several of the engineers and medical men. From the time of our arrival at Porto Velho till we left, we were shown the greatest hospitality by everyone in the foreign colony. Dr. James Laidlow and Messrs. Nixon and Troop cared for us in their homes at Porto Velho, while along the line of the railroad and in the construction camps everyone gave us all possible assistance. Some of the men, as Messrs. H. N. Burton and Fry, themselves interested in insects, collected during spare hours and generously turned over to us such specimens as we wanted. It is impossible adequately to express our appreciation of the kindness with which we were treated while on the Madeira-Mamoré.

As a great deal of territory was covered, and several distinct faunal regions visited, it seems advisable to give a list of the localities in which collections were made. These are:

State of Rio Grande do Norte.

Natal. On the coast, in an arid, sandy and wind-swept district.

Ceará-Mirim. North of Natal. The immediate vicinity of the town is well cultivated, with fields of cane and cotton, and considerable woody land and abundant water.

Baixa Verde. The terminus of a little railroad running out of Natal in a northwesterly direction. The surrounding country is hilly and very arid, with much scrub and cacti. At the time we collected here everything was dry and collecting was to be had only beneath stones, with which the ground was strewn.

State of Parahyba.

Independencia. Dr. Heath and I spent a week at the little village of Itamatahy, near Independencia, as guests of Messrs. Nye and Tessire, engineers on the local railroad. The country is hilly, with abundant vegetation and water. Bamboo breaks afforded interesting collecting.

State of Ceará.

Ceará. On the coast in extremely arid surroundings. There is a good stream near the city, along which was a fairly abundant fauna. This and the following are type localities of many of the ants described by Mayr and Forel.

Baturité Mountains. Mr. Williams, the Director of the railroad between Ceará and Inixadá gave the members of the Expedition an excursion to the latter village. *En route* it was possible to collect at several points in the mountains.

Maranguapé Mountains. Mr. Lieb, Assistant Geologist of the Expedition, and the writer made a side trip into these mountains and collected for a day. In the humid canyons and on the hillsides were taken several species not found elsewhere.

State of Pará.

Pará. Nearly all of the material labeled Pará was taken in the forest on the outskirts of the suburb Souza.

Santarem. Visited on our return trip down the river. We were able to spend only a few hours here, chiefly among the scrub in the sandy region back of the town.

State of Amazonas.

Itacoatiara. On the north bank of the Amazon, about forty miles below the mouth of the Rio Madeira.

Porto Velho. The starting point of the Madeira-Mamoré Railroad, near the border of Matto Grosso, about three miles from the Brazilian village of São Antonio.

State of Matto Grosso.

Abuná. On the Brazilian side of the river, nearly opposite the mouth of the Rio Abuna which forms the boundary of Bolivia and the Brazilian State of Matto Grosso.

Madeira-Mamoré R. R. Camps. Collections were made at a number of construction and other camps along the line of the railroad. The numbers of the camps are given as data. The locality can be most exactly expressed by giving the distances in kilometers from Porto Velho. These are:

Camp No. 28	170 kms.
" " 39	284 "
" " 41	306 "
" " 43	325 "

My study of the collection of Formicidæ has been made possible through the aid of Prof. W. M. Wheeler who has constantly followed the course of my work and generously permitted me to use his extensive collections and library at all times.

I wish to thank Dr. J. C. Branner, through whom I was enabled to accompany the expedition, and Dr. Fred Baker, Dr. Harold Heath, Prof. E. C. Starks and Messrs. Olaf Jenkins, Earl Leib and George Branner, members of the Stanford Expedition, as well as Prof. Chas. T. Brues of the Bussey Institution, all of whom have assisted me in various ways.

PONERINAE.

1. *Acanthostichus brevicornis* Emery.

Three workers taken from beneath a deeply imbedded stone at Independencia, agree closely with Emery's description of *A. brevicornis* from Cayenne. The length varies from 3 to 6 mm. The head is considerably longer than broad, with straight, parallel sides. The antennal scapes are short and broad. There was only a small number of workers together and all but three escaped.

2. *Paraponera clavata* (Fabricius).

Found commonly at Pará, Manaos, and along the Rio Madeira at Abuná, Porto Velho, and Camps 39 and 41. ☿ ♀.

Next to *Dinoponera grandis* Guérin, this is the largest of the Brazilian ants. It is much more widely distributed than *D. grandis*, occurring from Central America to Paraguay. In habit it is diurnal. The colonies are composed of a small number of individuals, which nest in the ground, generally among the roots of trees or shrubs.

3. *Platythyrea angusta* Forel.

A series of workers from Porto Velho, Abuná, and Madeira-Mamoré Camp 39 agrees well with the description, but have the anterior femora much swollen at the base. Dr. Forel recently showed me the type, which also has enlarged femora. This species, originally described from Trinidad, is more slender than the other South American forms, and the petiole is twice as long as broad. These characters, and the structure of the femora distinguish it from the others.

4. *Platythyrea incerta* Emery.

A single worker from Madeira-Mamoré Camp 41 agrees closely with Emery's description. It differs from *P. punctata* in being much larger (length 8 mm.) and in having the head shorter and the punctuation considerably coarser.

5. *Platythyrea meinerti* Forel.

Plate 1, figs. 2, 3; Plate 7, fig. 53.

A colony of this species was found at Pará in one part of a termite nest, a favorite nesting place of the genus, which is probably largely termitophagous in habit. This species is characterized by the strongly bisinuate petiolar node and the large eyes, which are as long as their distance from the anterior border of the head. A full-grown larva is shown Plate 7, fig. 53.

The following table may help in separating the South American species of Platythyrea.

A. Mandibles dentate.
Length 8 mm. (Surinam) .... *sinuata* Roger.
AA. Mandibles without teeth.
a. Eyes as long as their distance from anterior border of head; petiole strongly bisinuate, the middle portion prolonged into a short beak. Length 7.5 mm. (Venezuela, Brazil) .... *meinerti* Forel.
aa. Eyes smaller, petiole feebly sinuate.
b. Petiole from above more than twice as long as broad, as long as first segment of gaster; femora swollen. Length 6.7 to 7.7 mm. (Trinidad, Brazil) ...... *angusta* Forel.
bb. Petiole from above less than twice as long as broad, femora normal.
c. Punctures on epinotum very coarse, dilatation of frontal lobes more marked. Length 8 mm. (Venezuela, Brazil). *incerta* Emery.
cc. Punctures on epinotum finer, dilatation of frontal lobes less marked. Length 6 to 7 mm. (Antilles, Central and South America) .... *punctata* Smith.

6. *Typhlomyrmex rogenhoferi* Mayr.

One small colony, taken from a rotten log at Para. ☿.

7. *Rhopalopone relicta*, sp. nov.

Plate **1**, fig. 4, 5.

Worker. (Plate **1**, figs. 4, 5). Length 2.5 mm.

Head, excluding mandibles, distinctly longer than broad, broadest behind eyes, the width at occiput about equal to that at base of clypeus; sides slightly rounded, posterior border feebly concave. Mandibles long, rather slender, the blade minutely dentate; outer border arcuate at middle. Clypeus subtriangular, broadly rounded at anterior border, flattened in the middle. Frontal carinae very short, their basal lobes rounded. Antennae robust; scapes arcuate, extending barely to the occipital corners; first funicular joint as long as the two succeeding joints together; joints 3 to 9 broader than long; apical joint twice as long as the penultimate. Eyes small, convex; situated at middle of sides of head. Prothorax slightly transverse, rounded dorsally and laterally. Promesonotal suture faintly impressed. Mesoëpinotal suture not discernable. Epinotum in profile slightly convex above; its base rounding into the declivity and equal to it in length. Petiole from above transverse, sides rounded; in profile deeper than thick, anterior surface nearly straight, the posterior concave; ventral surface with a large flat tooth anteriorly. Gaster about as long as the thorax and epinotum together; first and second segments subequal, the former with a large anteroventral tooth. Legs robust; posterior coxa armed with a large curved spine.

Sublucid. Head regularly, longitudinally striate and rugose. Thorax and epinotum shining, sparsely punctate, their pleurae coarsely striate transversely. Epinotal declivity transversely striate. Petiolar node with transverse rugæ. Gaster with coarse longitudinal striæ. Legs finely punctate and shining.

Head, antennae, body, and legs with fine short pilosity.

Color brownish red; legs, mandibles, and antennae brownish yellow. Pilosity white.

Described from several workers taken at Madeira-Mamoré Camp 39.

This distinct species is the first Rhopalopone to be recorded from America, the four other known species inhabiting Borneo and New Guinea.

8. *Holcoponera striatula* Mayr.

Very common in the vicinity of Natal, where it was nesting beneath stones and logs, in rather large colonies. One colony was found at Pará. ☿ ♀.

9. *Holcoponera mölleri* Forel.

A single worker from Madeira-Mamoré Camp 39 agrees with Forel's description of this species from Blumenau. It is larger than *H. striatula*, the mandibles are more coarsely striate and all the funicular joints are distinctly longer than broad. In its other characters it is very similar to *H. striatula*.

10. *Ectatomma* (*Ectatomma*) *quadridens* (Fabricius).

Plate **7**, fig. 54.

This species was very common at Independencia, Ceará-Mirim, Pará, Itacoatiara, and Manaos. In a nest excavated at the first named locality, the brood chambers were about two and a half feet beneath the surface, in very hard dry earth. Although *E. quadridens* is very common in collections, the male appears to be undescribed.

Male. Length 10 mm.

Head, excluding mandibles, as broad as long, with rounded occipital border. Cheeks two thirds as long as eye. Mandibles well developed, shaped like those of the worker, but smaller. Eyes and ocelli large and convex. Antennae slender, the scape thick and short, about half as long as eye; first joint of the funiculus one third as long as the scape, joints 3–12 cylindrical, four to five times as long as broad; apical joint one and a third times the length of penultimate. Pro- and mesothorax rounded above and at sides. Epinotum rounded; the declivous surface broad and flat, feebly marginate at base, with small lamellate tubercles. Node rounded, transverse, its height about equal to its length; anterior surface flat; with a tubercle anteroventrally.

Head and thorax opaque, rugulosely striate. Mandibles coarsely striate. Antennae finely punctate. Node and first two segments of gaster subopaque, the latter densely striolate longitudinally.

First four joints of antennae sparsely, the rest thickly pubescent, with a few short, erect hairs. Head and thorax with pubescence and a few erect hairs. Node devoid of pubescence, but pilose. Gaster sparsely pubescent and abundantly pilose. Legs finely pilose.

Color black; genitalia brown. Wings (length 6.5 mm.) infuscated; veins and stigma fuscous.

The larva is shown Plate **7**, fig. 54.

11. *Ectatomma* (*Ectatomma*) *ruidum* (Roger).

Less abundant than the preceding species. Found at Ceará-Mirim, Manaos, and Camps 39 and 41 Madeira-Mamoré RR. ☿.

12. *Ectatomma* (*Ectatomma*) *tuberculatum* (Olivier).

Common at Pará, Itacoatiara, Manaos, and along the Rio Madeira. ☿ ♀.

Workers are often seen moving slowly about or remaining motionless on the stems and leaves of trees and shrubs. The species is partly nocturnal in habit and often enters houses and hunts about for other insects that come to the lights. A nest which I dug out was in the ground among the roots of a plant, about twelve inches below the surface.

13. *Ectatomma* (*Ectatomma*) *confine* Mayr.

Plate **1**, fig. 8.

A single worker (Plate **1**, fig. 8), which agrees well with Mayr's description, was taken at Porto Velho. Apparently the species has not been recorded since Mayr described it from a Colombian specimen.

The structure of the pronotum is very characteristic. The middle tubercle is prolonged and flattened above, and laterally compressed in front of the pleural spines so that it has the form of a short, thick carina. The lateral spines on the pronotum are short, flattened, and triangular; the epinotal spines are prominent. The sculpture of the head is coarse, that of the rest of the body delicate. The head, thorax, and abdomen are sparsely beset with coarse, erect hairs.

14. *Ectatomma* (*Gnamptogenys*) *concinnum* (F. Smith).

Plate **1**, fig. 7.

Workers (Plate **1**, fig. 7) were found at Porto Velho, Abuná, and Madeira-Mamoré Camp 39.

15. *Ectatomma* (*Gnamptogenys*) *tortuolosum* F. Smith.

Plate **1**, fig. 6.

Worker. (Plate **1**, fig. 6.) Length 7 mm.

Head, excluding mandibles, a little longer than broad, with slightly convex sides, narrowly rounded posterior corners and concave border. Clypeus nearly as long as broad, the surface depressed; anterior border straight. Mandibles slender, the blade edentate. Antennae robust; scape thickened apically, extending one fourth its length beyond the occipital corners; funicular joints 1 to 3 elongate, subequal; joints 3–6 globose, a little longer than broad. Eyes moderately large, convex, situated at middle of sides of head. Thorax above without sutures. Prothorax rounded above in front and at sides. Epinotum in profile nearly straight at base, the declivity sloping gradually. Petiole longer than broad, broadest behind, with rounded posterior border, straight sides and straight, margined anterior border, the corners of which project angulately; in profile higher than long, rounded above. Gaster short and thick. Legs rather slender.

Head shining, longitudinally striate, the striae coarse and regular, becoming oblique at sides, perpendicular on cheeks; the intervening ridges rounded. Thorax shining, sculptured similarly to head; the prothoracic striae longitudinal at middle, arcuate at sides, forming a somewhat concentric pattern. Striae of epinotum transverse at middle, obliquely longitudinal at sides. Petiole concentrically striate. Gaster subshining, the first two segments longitudinally striate.

Head, body, and legs with abundant, rather fine erect hairs.

Color piceous, legs and antennae fuscous.

The specimen before me has the antennae mutilated.

Described from a worker found dead, at Madeira-Mamoré Camp 41. The specimen runs to *E. tortuolosum* in Emery's key to the species, and answers to Smith's very superficial description, but differs from the form considered as this species by Emery (Studi sulle formiche della fauna Neotropica. Bull. Soc. ent. Ital., 1896, **28**, p. 51) in the structure of the petiole, which forms an acute angle above in profile in *E. tortuolosum*. It is doubtful whether this or Emery's specimen (which came from Pará) belongs to Smith's species.

16. *Ectatomma* (*Gnamptogenys*) *sulcatum* (F. Smith).

Several workers and females from Porto Velho. The striae extend the entire length of the thorax; those of the node and first gastric segment are also longitudinal, but slightly arcuate on the sides. The color is bright ferruginous, with the head black and the mandibles pale yellow.

17. *Ectatomma* (*Gnamptogenys*) *sulcatum* var. *nitens*, var. nov.

Three workers from Manaos and Independencia.

In form and sculpture this variety is identical with the typical form, but is entirely black in color, except the mandibles which are yellow.

18. *Ectatomma* (*Gnamptogenys*) *annulatum* Mayr.

Not uncommon at Porto Velho, and Camp 39, Madeira-Mamoré R. R., where several females and workers were taken. Two workers from Pará are also in the collection. A nest was found in a cavity of a fence post, where the wood was rotten.

The striolation of *E. annulatum* is very delicate, longitudinal on the pro- and mesonotum, transverse on the epinotum and petiolar node. The specimens vary in color from fuscous to ferruginous. The legs of all are yellowish brown, with a fuscous blotch at apex of tibiae and femora.

19. *Dinoponera grandis* (Guérin).

Several specimens of the typical form of the species, as designated by Emery (Ann. Soc. ent. Belg., 1901, **45**, p. 47) were taken at Pará, in the suburb Souza. The subopaque gaster, abundance of hairs on the body and the well-developed ventral tooth of the pronotum, are characteristic of this form. The petiole in profile is quadrangular, as high behind as in front, and the thorax and gaster bear fine recumbent pubescence, which gives a brownish appearance to the body.

20. *Dinoponera grandis* subsp. *lucida* Emery.

Two workers from Porto Velho.

This subspecies differs from the typical *D. grandis* in having the prothorax, node, and gaster shining; the petiole from above is more slender and in profile has the upper surface convex instead of nearly straight; the prothoracic spine is lacking; the pubescence of the thorax is more dense.

21. *Dinoponera grandis* subsp. *mutica* Emery.

Plate **7**, fig. 55.

Abundant at Natal, Baixa-Verdé, Ceará-Mirim, and Independencia. The prothoracic spine is absent; the node shorter than in the typical *D. grandis,* in profile pointed in front, rounded behind. The body is more shining, the pilosity and pubescence less conspicuous.

There were several colonies of *D. mutica* in the vicinity of our house at Natal, nesting among scrubby vegetation. The typical *D. grandis*, in the forest, is seen foraging all through the day, but *D. mutica*, living in more open localities, is crepuscular or nocturnal, though it forages also on cloudy days. The formicaries were always in thickets, among the roots of trees. The mounds thrown up are low, generally not over six inches in height, and often up to three feet in diameter. Dr. Heath and I dug out one nest. The tunnels extended along the underside of roots, which formed projecting roofs. Along these tunnels were frequent broad and flat chambers, which contained the brood. In spite of the large size and powerful sting, the ants were not very pugnacious, though those in a chamber would sally out when it was cut into.

Dinoponera grandis and its varieties are known to the Brazilians as the "Tocandero," and according to them its sting causes fever.

A larva (Plate **7**, fig. 55) probably immature, in alcohol measures 13 mm. in length. The body is thick and the neck short. All the segments are distinct, with fine, short hairs. The head is glabrous, from above a little broader than long; the mandibles long and acuminate. The thorax and abdomen are tuberculate, the tubercles very large and prominent, rounded above, each bearing a small sensory papilla at the middle. Each segment has three of these large tubercles laterally, and a smaller, less conspicuous one basally.

22. *Dinoponera grandis* var. or subsp.

Male. Length 21 mm.

Head, including the mandibles, as broad as long, very convex behind. Eyes very large and long occupying the entire sides of head, the inner border deeply emarginate; ocelli very large and convex. Clypeus convex, the anterior border truncate. Mandibles small, pointed at apex, with a small tooth at middle of inner border. Antennae a little shorter than the body; first funicular joint twice as broad as long; joints 2–11 very long, cylindrical, each slightly shorter and more slender than the preceding. Thorax robust; scutellum short, triangular, broadly rounded at apex. Epinotum evenly rounded, without distinct base or declivity, unarmed. Petiole nearly twice as long as broad, narrowed in front, with nearly straight sides; in profile longer than high, flattened above, the anterior slope gradual, more abruptly sloping behind, the anteroventral surface with a broad, triangular projection. Gaster long, and slender, the length three times the breadth. Genitalia prominent; the valves broad, rounded at apex; cerci long and slender. Wings large, extending almost to tip of gaster. Legs very long and slender.

Body and legs shining. Antennae opaque, coarsely, densely punctured; sparsely pubescent, and having much very long, fine erect hairs, which on the apical joints are shorter and confined to the tips; pubescence of apical joint more dense than the rest. Thorax with long silky pubescence, most abundant on the pleurae, and very fine erect hairs sparsely distributed. Node without pubescence, but with abundant erect hairs. Gaster with a thin mat of silky pubescence, shorter and finer than that of the thorax; lateral and apical portions with fine erect hairs.

Color rufous, the antennal scape and first five funicular joints fuscous. Wings slightly infuscated, veins and stigma reddish brown. Pile and pubescence yellowish white, except the long antennal hairs which are black.

Described from three examples, which were taken at lights in Independencia. This form which is probably the male of the variety *D. mutica*, the commoner form in this vicinity, is very much like a male thynnid in general habitus. The antennae bear unusually long hairs, which are abundant basally, but thin out and become shorter toward the apex.

23. *Neoponera* (*Neoponera*) *commutata* (Roger).

Porto Velho and Camp 39, Madeira-Mamoré R. R.

24. *Neoponera* (*Neoponera*) *apicalis* (Latreille).

Pará, Porto Velho, Abuná, and Camps 39, 41, Madeira-Mamoré R. R.

25. *Neoponera* (*Neoponera*) *obscuricornis* Emery.

Abuná and Porto Velho. ☿

In general appearance this species is very similar to the preceding. It can be distinguished by the structure of the node. In *N. apicalis* this is sharply margined at the sides, and longitudinally impressed medially to the margin. *Neoponera obscuricornis* has the surface of the node slightly convex, not impressed; the margin is very feeble at the base and entirely obsolete on the apical half.

26. *Neoponera (Neoponera) latreillei* Forel.

Pará, Porto Velho, and Camps 39, 41, Madeira-Mamoré R. R. ☿ The large size and active movements, with the contrast in color between the black body and yellow tipped antennae make *N. latreillei* one of the most conspicuous ants in the forest.

A small colony, of perhaps thirty individuals, found at Pará, was nesting beneath a banana stalk in a dense thicket. The ants were very timid and ran away quickly, but returned one by one to carry off their brood.

27. *Neoponera (Neoponera) unidentata* (Mayr).

Pará, Manaos, Porto Velho, and Camps 39, 41 Madeira-Mamoré R. R. ☿ ♀

28. *Neoponera (Neoponera) bakeri*, sp. nov.

Plate 1, fig. 9.

Worker. (Plate 1, fig. 9). Length 8 mm. Near *N. unidentata* (Mayr). Head, excluding mandibles, longer than broad, subquadrate, sides feebly convex, posterior angles obtuse; occiput concave; carina on cheek strong; clypeus at middle prolonged into a sharp point, concave at sides. Mandibles rather thick, triangular, with twelve small teeth, the apical and two subapical larger than the others and subequal. Eyes convex, a little in front of the middle of head. Antennal scapes extending three eighths their length beyond the occipital corners; apical joint of flagellum nearly twice as long as penultimate. Thorax, seen in profile, moderately convex. Pronotum convex, strongly margined at sides, the margin indistinctly serrate. Mesonotum nearly circular, disc-like. Mesoëpinotal impression shallow, but distinct. Metanotum convex basally; declivity gradual, the surface nearly flat, on either side with a prominent marginal carina on which are three distinct triangular teeth. Node highest in front; anterior surface straight to apex; posterior surface, seen in profile, strongly convex, base slightly concave, margined at sides, margin with three to five distinct teeth. Gaster as long as thorax and head excluding mandibles.

Head coarsely, longitudinally striate, the striae irregular and wavy; mandibles sublucid, smooth. Pronotum more finely transversely striate. Striae of meso- and epinotum coarse, on mesonotum and disc of epinotum transverse, on sides longitudinally oblique. Node shining, with coarse, transverse striae, which extend around it, broken only by the strong margin. Gaster sublucid; first segment minutely punctate.

Head and thorax with fine recumbent pubescence, and abundant, scattered, erect pile. Node without pubescence, and with scarce pilosity. Gaster with a dense mat of fine recumbent pubescence, and abundant, scattered, erect pile.

Femora and tibiae with short erect hairs, smooth and shining.

Color black; mandibles, antennae, tibiae, and tarsi brown, femora yellow. Pile and pubescence pale yellow.

Female. Length 11 mm.

Similar to worker. The eyes are small, ocelli minute. The thoracic striae are proportionately much finer than in the worker, and transverse. The declivity of the epinotum is abrupt, the base shallowly margined; margin with fine teeth. Node as in worker.

Pile and pubescence as in worker. Color black; legs, mandibles, and extreme tip of antennae brown.

Wings. Length 7.5 mm. Infuscated, veins and stigma fuscous.

Described from one female from Porto Velho and several workers taken on the Rio Madeira at Porto Velho, and Camps 39 and 41 on the Madeira-Mamoré R. R. This species in form is similar to *N. unidentata* (Mayr), which was common in the same region, but the very distinctive coarse sculpture of the head, thorax, and especially of the node, and the denticulate margins of the epinotal declivity and the posterior surface of the node, as well as the different nodal structure seem to constitute differences more than subspecific.

29. *Neoponera* (*Neoponera*) *villosa* (Fabricius).

Pará, Manaos, Itacoatiara, Porto Velho, Abuná, and Camps 39, 41 Madeira-Mamoré R. R., Brazil; and Abuná, Bolivia.

This is one of the commonest ponerine ants of Brazil, and one of the most widely distributed species, ranging from Texas to Paraguay.

30. *Neoponera* (*Neoponera*) *carinulata* (Roger).

Plate 1, fig. 10.

Worker. (Plate 1, fig. 10). Length 8 mm.

Head, excluding mandibles, scarcely longer than broad, very slightly narrowed in front; occipital border nearly straight; sides feebly convex; clypeus prolonged at middle, the apical portion narrowly rounded; frontal carinae above antennal lobes slightly diverging outwardly. Mandibles triangular; about $\frac{5}{8}$ as long as head, the blade with twelve distinct teeth. Carinae on cheeks very distinct. Antennae slender; the scapes extending one third their length past occipital corners; funicular joints all longer than broad, increasing in size toward the tip. Prothorax transverse, longitudinally carinate at middle, flattened above; sides strongly margined, in profile slightly convex. Mesonotum circular, with a median, longitudinal carina, on either side of which the surface is depressed; in profile flat. Epinotum in profile evenly convex, with no appreciable angle between base and declivity; anterior portion rounded above and at sides; declivity margined, with an indistinct tubercle at middle of margin; surface flat. Petiole as broad as long, broadest behind, sides evenly convex; posterior margin straight, in profile three fourths as thick as high, with anterior surface horizontal from base to two thirds the distance to apex, then inclined to apex; posterior surface with a disc at middle, rounded on the sides. Gaster cylindrical, as long as thorax and petiole together.

Somewhat shining. Mandibles finely striate. Head foveolately punctate; thorax and node finely punctate, the epinotal pleurae striolate.

Head, thorax, and node with sparse, fine, appressed pubescence and scattered, erect hairs. Posterior surface of node smooth and shining. Gaster rather densely pubescent and with scattered, long pile. Legs sparsely pubescent and pilose.

Color black; antennae, mandibles, and legs brown. Pile and pubescence silvery.

Described from two workers taken at Abuná.

31. *Neoponera* (*Neoponera*) *crenata* Roger subsp. *moesta* Mayr.

One colony was found at Porto Velho.

32. *Neoponera* (*Neoponera*) *stipitum* Forel.

A single worker from Camp 41, Madeira-Mamoré R. R. agrees very well with a cotype from Colombia in the Wheeler collection.

33. *Neoponera* (*Neoponera*) *cavinodis*, sp. nov.

Plate 2, fig. 14.

Worker. (Plate 2, fig. 14). Length 10 mm.

Near *N. luteola* (Roger). Head, excluding mandibles, longer than broad; sides convex, base slightly concave, posterior angles rounded; clypeus extended at middle into a triangular projection, the sides arcuately impressed. Mandibles elongate, acute at apex, with twelve teeth, the basal of which are small and those apically larger; the apical tooth is long and pointed, attached at base to this is a smaller sharp tooth, about half as long, and basal to this another, slightly longer and more acute than the subapical. Eyes convex, situated a little in front of middle of head. Scape of antenna extending three eighths its length past occiput; joints 1–10 of flagellum subequal in length, gradually thicker towards the apex; apical joint $1\frac{1}{2}$ times length of penultimate. Pronotum slightly convex, sides feebly margined, forming an angle with the nearly flat pleurae; disc at middle with a shallow, but distinct longitudinal impression. Mesoëpinotum in profile very slightly convex, rounded at sides posteriorly, and in back, the mesoëpinotal suture scarcely distinguishable: declivity of epinotum rather flat, with feeble margin at sides; above forming a rounded angle with the basal portion; seen from behind spear-shaped, the apex with a short longitudinal impression. Petiole higher than thorax, anterior surface evenly rounded to apex, the middle of base very slightly convex; apex projecting backward over the posterior surface; posterior surface receding anteriorly, concave above, slightly convex below. Gaster as long as head and thorax.

Mandibles subshining, with scattered, coarse punctures. Head subopaque, very finely transversely striate and with minute punctures. Thorax and anterior surface of petiolar node sublucid, finely punctate and delicately reticulate. Gaster finely punctate. Legs shining. Head and thorax with fine pubescence and long scattered pile. Clypeus with several long hairs. Anterior surface of node with appressed pubescence, the posterior surface glabrous. Gaster thickly pubescent and with long scattered hairs. Femora and tibiae with suberect hairs.

Color brown, head and gaster darker than the thorax. Legs yellow.

Pile and pubescence pale yellow.

Described from a worker taken at Porto Velho.

In general appearance *N. cavinodis* resembles *N. crenata* but is much larger and the node is entirely different.

34. *Pachycondyla crassinoda* (Latreille).

Taken at Pará, Porto Velho, and Madeira-Mamoré Camp 39.

35. *Pachycondyla harpax* (Fabricius).

Common at Pará Manaos, Porto Velho, Abuná, and Camp 41, Madeira-Mamoré, R. R.

36. *Euponera* (*Trachymesopus*) *stigma* (Fabricius).

This species, which is common everywhere in the American tropics is represented in the collection by workers and females from Pará, Itacoatiara, Manaos, Porto Velho, Abuná, and Camps 39 and 41, Madeira-Mamoré R. R. Rotten logs and beneath bark are its favorite nesting places.

37. *Belonopelta jeckylli*, sp. nov.

Plate **2**, fig. 12, 13.

Worker. (Plate **2**, fig. 12, 13). Length 4.5 mm.

Head very thick dorsoventrally; excluding mandibles, a little longer than broad, broadest anteriorly, with straight sides, narrowly rounded occipital corners and feebly concave occipital border. Clypeus convex; at anterior border armed with a stout spine at middle. Mandibles five eighths as long as head, slender, bidentate at apex; the inner border with a large tooth at middle, and a minute one midway between this and the subapical tooth. Antennae robust; the scapes slightly arcuate, thickened distally, almost attaining occipital corners. First funicular joint longer than broad, joints 2–10 slightly transverse, those at the apical end subglobose; apical joint as long as the three preceding together, evenly narrowed from base to apex. Eyes minute, situated at anterior third of sides of head. Prothorax with a thick neck. Pronotum from above, excluding the neck, a little broader than long, rounded in front and at sides, the posterior border concave. Promesonotal suture very strongly impressed. Mesonotum about half the width of pronotum, rounded in front, sides nearly straight, in profile slightly convex. Mesoëpinotal suture feebly impressed. Epinotum twice as long as the mesonotum, and a little broader, broadest behind, sides nearly straight; in profile gradually elevated from base to angle of declivity; declivity half as long as the basal part, with the surface flattened. Petiole from above very little broader than long, anterior margin straight, at corners of base with prominent lamellate projections, that appear as spines from above; sides rounded, posterior border feebly rounded; in profile deeper than thick, with nearly straight anterior and posterior surfaces, slightly convex above. Gaster.cylindrical, strongly narrowed toward apex; the first segment noticeably broader than the second and equal to it in length; a distinct ventral spine present at base. Sting comparatively large. Legs very slender.

Head, thorax, and petiole subopaque, closely, foveolately punctate throughout; pleurae of pro- and mesothorax and anterior coxa obliquely rugulosely striolate; collar transversely rugulose-striolate. Mandibles shining, finely punctate. Antennae and legs subshining, finely punctate. Gaster shining, minutely punctate.

Body, legs, antennae, and mandibles with semierect pilosity.

Head, mandibles, thorax, and petiole fuscous to piceous; borders of the frontal lobes, a round spot on the pronotum, the gaster and legs red. The borders of the gastric segments are infuscated.

Described from several specimens taken at Camp 39, Madeira-Mamoré R. R. The colony was discovered quite accidentally by scratching away some of the leaves and debris with which the ground in the forest is always covered. As far as I could ascertain the ants were traveling in a definite direction. Some of those before me are red in color, evidently immature. Nothing seems to be known regarding the habits of the species of this interesting genus, specimens of which are rare in collections. The four known species have each been found only once.

38. *Ponera trigona* Mayr.

One small colony was found at Manaos.

39. *Ponera opaciceps* Mayr.

Several colonies were taken at Ceará-Mirim.

40. *Ponera distinguenda* Emery.

Numerous workers were taken at Camp 39, Madeira-Mamoré R. R.

41. *Anochetus* (*Anochetus*) *mayri* Emery.

A single worker of this widely distributed species was taken at Baixa Verde.

42. *Anochetus* (*Anochetus*) *bispinosus* (F. Smith).

Plate **1**, fig. 11.

Worker. (Plate **1**, fig. 11). Length 8 mm.

Head, excluding mandibles a little longer than broad; broadest at eyes; occipital border deeply excised; sides above eyes concave, below sinuate, with the lower surface flattened. Eyes large, and convex. Clypeus between frontal lobes triangular, the surface flat, anterior portion bilobed; border concave at middle. Frontal carinae short. Mandibles about two thirds as long as head, narrow at base, broad and flat anteriorly, the blade edentate to near apex, where there is a short, thick tooth; apex with two long teeth, between which is a smaller, acute tooth. Antennae slender, the scape curved, thickened at middle, extending one eighth its length beyond the occipital corners; funicular joints long and slender, 1 to 10 subequal, apical joint nearly twice the length of subapical. Prothorax much narrowed in front, rounded above and at sides, the posterior border slightly concave. Promesothoracic suture deeply impressed; mesothorax transverse, rounded above and at sides. Mesoëpinotal impression deep and broad; epinotum much narrower than prothorax, straight at sides and above to the declivity, which is very short, and concave; angle with a pair of short, acute, erect spines. Node triangular, the apex with a pair of strong spines, between these broadly concave. Gaster short and thick, the first segment with a small ventral tooth. Sting long and powerful. Legs long and slender.

Head in front subshining, with dense striolae, which extend upward and outward from the frontal area; the remainder of head and the mandibles smooth and very shining. Antennae sublucid, finely pubescent. Thorax shining, rugosely punctate; the mesothoracic pleurae smooth. Node shining, transversely rugose in front, smooth behind. Legs and gaster shining, finely punctate.

Head in front with sparse pubescence, and a few erect hairs. Prothorax, gaster, and coxae with very sparse erect gray hairs. Femora and tibiae thinly pubescent.

Color black, the mandibles, posterior corners of head, and the nodal spines brownish; legs and tip of gaster ferruginous. Pubescence white.

Described from a single worker taken at Porto Velho. The specimen on which Smith based his description was from Ega (Bates), so it is probable that the species extends over much of the Amazonian region.

43. *Anochetus* (*Stenomyrmex*) *emarginatus* (Fabricius) subsp. *rugosus* Emery.

Male. Length 7 mm.

Head, excluding eyes, considerably longer than broad, rounded behind. Eyes very large, each three fourths as broad as the distance between them, convex, as long as sides of head. Ocelli very large and convex. Mandibles, short, feeble, straight, and without teeth. Clypeus truncate at anterior border; surface broadly foveolately depressed at sides. Antennae very long and slender; the first joint twice as long as the second; joints 3–11 cylindrical, subequal, very long. Thorax narrower than head. Promesonotum convex above. Epinotum in profile evenly rounded. Node longer than broad, in profile triangular, much longer than thick. Gaster long and slender, without a distinct constriction between the first and second segments. Legs long and slender.

Body shining throughout, smooth, with extremely fine semierect pilosity, which is thickest on the antennae. Head and mandibles with a few coarser hairs.

Color light testaceous; antennae, excepting first joint, fuscous; eyes black. Pilosity white.

Described from several specimens taken at Manaos, from colonies which were nesting beneath the bases of living palm-tree leaves. Other colonies were found at Porto Velho beneath logs. The male is very active and takes flight readily.

44. *Odontomachus affinis* Guérin subsp. *mayi* Mann.

The single colony of this form was found living in parabiotic relations with *Dolichoderus debilis* Emery var. *rufescens* Mann, an account of which has already been published.

45. *Odontomachus haematoda* (Linné).

Pará, Manaos, Porto Velho, and Camp 41, Madeira-Mamoré R. R.

46. *Odontomachus haematoda* subsp. *pubescens* Roger.

Very common at Ceará, in the Maranguapé Mts., Independencia, Natal, and Ceará-Mirim. This form is distinguished from the typical *O. haematoda* by the more abundant pile and pubescence, and by the coarser sculpture of the node, which is only feebly striate in the latter form.

47. *Odontomachus haematoda* subsp. *laticeps* Roger.

Porto Velho and Camp 41, Madeira-Mamoré R. R.

This was much rarer than the above mentioned forms.

Dorylinae.

48. *Eciton* (*Eciton*) *hamatum* (Fabricius).

This species, which ranges from Mexico through Central America and over all of tropical South America, was very abundant in the region of the upper Rio Madeira. The armies, found in the woods almost every day, contained enormous numbers of individuals, mostly minors and mediae. One of the big-headed soldiers was encountered at intervals of from ten to twenty feet in the procession. This form is a very conspicuous object on account of its large, light-colored head and the long mandibles which necessitate the body being held high.

The march of the army is exceedingly rapid, and at times very definite in direction. Often it divides and sends some branches up into the tallest trees, while others cross and recross the trails. If an object such as a grub, lizard, or small snake be thrown near the column, it is almost instantly covered with the workers, which bite and sting severely. Unlike some of the other species, *E. hamatum* marches in the daytime and the column travels beneath or over the leaves, over logs, and along the trails. The trunks of fallen trees are a favorite runway. Other species of ants seem to be the usual prey of *E. hamatum*, for larvae and pupae of these made up the greater part of the booty carried by the workers. I observed on several occasions columns descending trees bringing numbers of larvae, pupae, and even adults of *Dolichoderus lugens* Emery, an ant which secretes from the anal glands a large drop of yellow liquid, apparently for defense.

In spite of its large size and the number of individuals in a column, *E. hamatum* is a timid species in comparison with some of the others, such as *E. vagans*. When the column was disturbed by my picking up some of the individuals, those nearest would turn about and run back, zig-zagging from one ant to another, apparently missing none. An instantaneous antennal communication took place, the warned ant turned also, and almost instantly the whole army was retracing its steps as rapidly as it had come. In a few moments some few would return and then more and in a short time the army would resume its march. At other times a new path was followed. This antennal communication and quick change of direction was observed also in *E. pilosum, E. crassicorne,* and *E. burchelli.*

49. *Eciton* (*Eciton*) *lucanoides* Emery.

Columns were found at Madeira-Mamoré Camps 39 and 41.

This species was originally described from Peru. The mandibles are armed with a strong spine on the inner side, a little in front of the middle. I am unable to distinguish the minors and mediae of *E. lucanoides* from those of *E. hamatum* by any single character.

50. *Eciton* (*Eciton*) *burchelli* (Westwood).

This species was moderately abundant on the Rio Madeira, where it was encountered several times at Abuná and at Camp 41, Madeira-Mamoré R. R.

It is rather more aggressive than the other species. When disturbed it attacks the intruder very fiercely and persistently. The pain produced by the sting is severe, but of short duration.

51. *Eciton* (*Eciton*) *rapax* F. Smith.

Two small files of this beautiful species were found at Porto Velho and Camp 41, Madeira-Mamoré R. R. These were running along beneath the loose covering of leaves on the ground.

The ants were very timid and the file dispersed as soon as it was disturbed.

52. *Eciton* (*Eciton*) *rogeri* Dalla Torre.

Several colonies were taken at Camp 39, Madeira-Mamoré R. R.

53. *Eciton* (*Eciton*) *vagans* (Olivier).

Found at Independencia and Baixa Verde, where files were frequently seen toward evening.

54. *Eciton* (*Labidus*) *coecum* (Latreille).

Ceará, Baturité Mts., Natal, Independencia, and Pará, Brazil and at Abuná, Bolivia. This is the most widely distributed and one of the commonest species. It is subterranean in habit, and often found beneath deeply embedded stones and logs. The specimens from Abuná were taken from beneath the putrid carcass of a sheep, and most of the individuals were dead or nearly so, possibly having been overcome by the gases of decomposition.

55. *Eciton* (*Labidus*) *praedator* F. Smith.

Common along the upper Rio Madeira, where it was taken at Porto Velho and Camps 28 and 39 Madeira-Mamoré R. R. One army was seen emerging from the commissary building at the first named station, carrying with it an incredible number of insects, mostly cockroaches. Houses along the railroad were frequently raided at night by *E. prædator*, which is well known to the Brazilians and called by them "cazadoro" (hunter). I had the opportunity of observing one hut while the ants were in possession. The ground was covered with the ants, which swarmed also in the cracks and on the few pieces of furniture, while the owner of the place, a Barbados negress, not accustomed to such intrusions, stood for safety in a puddle of soapy water with which she had attempted to drive the ants away, and begged me to tell her what to do to get rid of them.

56. *Eciton* (*Labidus*) *praedator* subsp. *emiliae*, subsp. nov.

Worker. Differing from the typical form in having the head and body largely opaque; the head more densely punctulate; the thorax and petiole with very few hairs. The pilosity of the gaster is much shorter and the pubescence is more dense; the color is reddish brown, becoming darker on the head.

A large series of this new subspecies was sent to me by Dr. Emilia Snethlage, who collected it at Colonia de Veado, near Obidos. Possibly this is the var. *ferruginea* Norton, which was described from Mexico, but has not been recognized since.

57. *Eciton* (*Labidus*) *crassicorne* F. Smith.

Common at Ceará-Mirim and at Carnahubinha (near Natal) where armies were frequently seen toward evening, either on the ground or in the nests of ground-inhabiting ants.

58. *Eciton* (*Labidus*) *esenbecki* (Westwood).

A single male of this species was taken at light at Porto Velho.

59. *Eciton* (*Labidus*) *sulcatum* (Mayr).

Several males were taken at light at Independencia.

60. *Eciton* (*Acamatus*) *nitens* Mayr.

A rather large colony of this distinct species, was found emerging at dusk from beneath our house at Independencia.

61. *Eciton* (*Acamatus*) *pilosum* F. Smith.

Taken at Independencia and Pará. Several armies were encountered. I collected a number of specimens from a large column which was crossing a railroad track at Independencia, whereupon the column broke up, but formed again and continued its march, this time beneath the rail. A column found in the woods at Pará was travelling underground, except where it crossed a path. Here it emerged and constructed a trail with embankments on each side.

62. *Eciton* (*Acamatus*) *legionis* F. Smith subsp. *crenulatum*, subsp. nov.

Plate 1, fig. 1.

Worker. (Plate 1, fig. 1). Length 3.5 to 5 mm.

Head, excluding mandibles, longer than broad, with nearly straight sides and rounded border; posterior corners angulate. Frontal carinae nearly straight. Outer border of antennal pits strongly carinate. Anterior margin of clypeus flat, projecting at middle. Mandibles stout; the blade edentate. Antennae robust; scape extending a third its length beyond the occipital corners, constricted near apex, then incrassate; funicular joints a little longer than broad. Eyes distinct, convex. Pronotum twice as long as broad, flat above, the lateral borders elevated into a rounded ridge, which is somewhat thickened at middle. Mesonotum separated from pronotum by a transverse ridge, elevated, concave at middle, strongly margined at sides; mesial to the margin is a longitudinal furrow and on the upper surface two parallel ridges. Base and declivity of epinotum subequal in length, the former flat above with margined sides; surface of the latter evenly convex. Petiole from above longer than broad; flat above, with straight, roundly margined sides. Postpetiole a little longer than broad, broadest behind, rounded above and at sides, anteroventral surface with a distinct tooth.

Head, antennae, thorax, and epinotum sublucid; coarsely, granulosely punctate, throughout, except for a rounded area mesial to the eye, which is finely punctate. Antennae, mandibles, petiole, postpetiole, and legs more shallowly punctate. Gaster smooth and shining.

Head, body, antennae, and legs with long erect hairs; funiculus pubescent.

Color black, antennae, and legs dark reddish brown. Pilosity yellow.

Described from several workers taken from a file that was running beneath the loose bark of a felled tree at Madeira-Mamoré Camp No. 39. This is a very distinct form because of its peculiar sculpture and the strong carinae on the thorax. The latter, especially those at the middle of the mesothorax, are interrupted so that in profile they appear as tubercles.

MYRMICINAE.

63. *Pseudomyrma arboris-sancti* Emery.

Plate **3**, fig. 21.

This species is widely distributed in northern South America, and many observations have been made on its relations to the trees of the genus Triplaris with which it appears to be always associated. The tree is well known to the Brazilians and Bolivians by the name of "palo santo," and the ant is called the "taschi." I was told that no living tree was ever without the ants and that the ants never nested elsewhere than in this plant. At Madeira-Mamoré Camp 43 Triplaris was fairly common in the woods and I examined some dozens, always finding the ant. The colonies contain an enormous number of individuals living throughout the whole plant, all parts of which are hollow. The workers are very aggressive and their sting is quite severe. Whether or not the ants derive any advantage from the tree other than a convenient place to nest I do not know, but there is no doubt that they protect the plant from almost any possible enemy. A Swiss rubber explorer, Otto Schmidt, who has spent many years in the forest and is a keen observer, told me that dead Triplaris plants never contain ant colonies. This suggests that the living plants do offer some attraction to the ant, other than shelter.

64. *Pseudomyrma oculata* F. Smith.

Many workers and females were found at Natal, nesting in hollow twigs. This is one of the smaller, more delicate species, the workers measuring 4 mm. in length. The head is two and a half times as long as broad, the sides parallel with large, flat eyes. The antennal scapes are short, extending only to anterior third of eyes. The petiole is flattened above, twice as long as broad, in profile nearly twice as long as thick. The color is dark fuscous throughout.

65. *Pseudomyrma caroli* Forel.

Many colonies were found at Itacoatiara, nesting in twigs on small trees near the river.

66. *Pseudomyrma nigriceps* F. Smith.

Several workers were found at Abuná and Madeira-Mamoré Camp 41.

This species resembles *P. rufa* in structure and size. The color is different and striking, the head being black, and the rest of the body and appendages testaceous. It was not common.

67. *Pseudomyrma flavidula* F. Smith.

Common at Independencia and Ceará-Mirim, nesting in grass culms, the characteristic nesting site of the species.

68. *Pseudomyrma rufa* F. Smith.

Plate 7, fig. 56.

Worker. Length 6 mm.

Head, excluding mandibles, a little longer than broad, slightly narrowed behind, with convex sides and straight posterior border. Clypeus strongly keeled at middle; anterior border straight. Mandibles well developed, the blades finely dentate. Antennae thick; first funicular joint two and a half times as long as broad; apical joint as long as the two preceding. Ocelli distinct, very close together. Pronotum transverse, depressed, strongly margined at sides, with narrowly rounded humeri. Mesonotum longer than broad, the surface with a disc-shaped impression at the posterior half. Mesoëpinotal impression shallow. Epinotum more elevated than pro- and mesonotum, margined at sides basally, the surface distinctly concave; declivity as long as base, in profile straight. Petiole in profile elevated behind, above evenly rounded from base to apex, nearly as high as long; from above, more than twice as long as broad, narrowed above, with roundly margined sides and a narrow longitudinal impression at middle; anteroventral surface with a minute tooth; posterior surface concave. Postpetiole from above a little broader than long. Femora slightly thickened.

Subopaque, granulosely punctate, with very sparse gray pile; pubescence not abundant, pollinose, white. Mandibles finely punctate and pilose.

Color ferruginous, the meso- and epinotum infuscated.

Female (deälated). Length 7.5 mm. (Plate 7, fig. 56).

Head, excluding mandibles, one and a third times as long as broad, the anterior and posterior borders of equal width; sides slightly convex, posterior border straight. Clypeus keeled at middle, the anterior border projecting, with a stout, triangular tooth at middle. Mandibles stout, the blade with a stout, triangular, basal tooth, then three minute teeth and long, pointed apical and subapical teeth. Thorax slender. Pronotum narrower than mesothorax, twice as broad as long, with subparallel, margined sides and narrowly rounded humeri. Petiole seen in profile much as in worker; from above it differs in having the surface flat, and not depressed except at the apex, where there is a deep excavation dividing it into two triangular portions. Sculpture and pilosity much as in the worker; the pubescence of gaster very fine and silky.

Color as in worker, but the head is more infuscated.

Described from a female and several workers found in a twig lying on the ground at Pará.

69. *Pseudomyrma gracilis* (Fabricius).

Many colonies of what seems to be the typical form of this species were taken from twigs at Manaos. The workers (7.5 mm. in length) are colored black, excepting a narrow border at the anterior of head, the clypeus, mandibles, the tips of the front, and intermediate femora and the tarsi, which are ferruginous.

70. *Pseudomyrma excavata* Mayr.

Three workers from Manaos agree with specimens from Costa Rica received from Dr. Forel.

71. *Pseudomyrma laevigata* F. Smith.

One small colony found in a twig at Manaos. The specimens are yellow in color, without trace of maculation.

72. *Pseudomyrma mutilloides* Emery.

A worker each from Itacoatiara and Camp 39 Madeira-Mamoré Railroad.

73. *Pseudomyrma subtilissima* Emery subsp. *tenuissima* Emery.

Taken at Natal and Maranhao. The colony from the latter locality was taken from beneath a loose piece of bark, quite an unusual situation for Pseudomyrma. The type of *P. tenuissima* is from Matto Grosso. Emery records a specimen also from Cayenne.

74. *Pseudomyrma maculata* F. Smith.

One colony from Natal is very doubtfully referred to this species.

The worker is 4 mm. in length.

Head large, broadest in front, sides convex, posterior margin truncate, much broader than pronotum; antennae thickened at apex, first funicular joint as long as second and third together. Metanotum evenly convex. First petiolar node elongate, slightly petiolate in front, about 1½ times as long as second node, which is globose.

Color yellowish brown, abdomen fuscous; epinotum with a faint median longitudinal fuscous stripe.

75. *Pseudomyrma elegans* F. Smith.

Found frequently in the vicinity of Manaos. This is the only known ground-inhabiting species of the genus. The nests found were in bare places along the roadside. The entrance is circular, about two millimeters in diameter, and directly on the surface, without a mound.

76. *Pseudomyrma elongata* Mayr.

Many colonies found at Ceará-Mirim and Independencia. One large tree at Ceará-Mirim contained hundreds of colonies nesting in hollow twigs and in galls, scarcely a dead twig or a gall being without them. The twigs inhabited are those hollowed naturally or bored by other insects. *Pseudomyrma elongata* is decidedly beneficial to the tree in keeping away insect enemies. The tree mentioned was especially well protected, having several Azteca colonies and some populous wasp nests in addition to the Pseudomyrma.

77. *Pseudomyrma sericea* Mayr var. *altinoda,* var. nov.

Worker. Length 4 mm.

Head one and one third times as long as broad, slightly broader in front than behind, with convex sides and concave posterior border. Clypeus with distinct notch at middle. Eyes large. Antennal scape reaching one third its distance from place of insertion to posterior border of head. Basal funicular joint not as long as two succeeding joints taken together. Pronotum with well-defined margin. Promesonotal and mesoëpinotal sutures equally pronounced. Mesonotum small, seen in profile lower than pro- and epinotum, transverse, about one half the length of the pronotum. Epinotum longer than pro- and mesonotum together, evenly convex above; its declivity shorter than length of basal surface; angle between the two surfaces much rounded. Petiole two thirds as long as thorax, its nodes higher than epinotum, equal in length; anterior node convex in front, declivous behind; posterior node nearly globose, broader than base of first segment of gaster. Gaster about as long as thorax. Legs robust.

Body opaque, everywhere with a fine mat of pale pubescence, and short, erect, pale pile.

Color fuscous, antennae and legs lighter. Differs from typical *P. sericea* in smaller size and fuscous color. *Pseudomyrma sericea* is black throughout, and the gaster is more robust.

Described from two workers from Porto Velho and one from Camp 39 Madeira-Mamoré R. R.

78. *Pseudomyrma gracilis* Fabricius subsp. *carapuna*, subsp. nov.

Worker. Length 10 mm.

Head, excluding mandibles, slightly longer than broad, contracted behind, with convex sides and slightly concave occipital border. Mandibles large and thick, with finely dentate blades. Clypeus small, slightly convex, anterior border truncate at middle. Antennal scape extending past opposite the middle of eye; first funicular joint three times as long as broad and longer than the second, apical joint as long as the two preceding together. Pronotum flat, with straight, distinctly margined sides and narrowly rounded, projecting humeri. Mesothorax transverse. Mesoëpinotal suture as long as the pro- and mesonotum together, nearly as broad behind as in front; its basal surface margined at sides, shorter than the declivity. Peduncle of petiole nearly as long as the node; node elongate-globose. Postpetiole longer than broad, pyriform, nearly twice as broad as petiolar node. Gaster long and slender. Legs with slightly thickened femora.

Subopaque; petiole, postpetiole, and gaster shining; finely, densely punctate throughout; mandibles subopaque, finely punctate.

Pubescence more abundant than in typical *P. gracilis*, white. Pilosity short and abundant on head and thorax, longer and more sparse on petiole, postpetiole, and gaster; black in color. Head, thorax, epinotum, and legs black, the tarsi brown; petiole, postpetiole, and gaster bright ferrugineous.

Described from two workers taken on a shrub at Abuná. This form is very distinct from the other varieties of *P. gracilis* in its much larger size, and the bicolored body. In the latter respect it resembles *P. agilis* Emery from Central America, but is very much larger.

79. *Pheidole* (*Elasmopheidole*) *aberrans* Mayr.

One colony was found at Independencia. This species is distributed along the east coast, in the more arid localities from north of Cape San Roque to Argentina. Among the specimens before me some of the soldiers have the vertex of head, the thorax and epinotum piceous. Others from the same colony are reddish brown throughout, agreeing in this respect with a series from Buenos Ayres (Silvestri coll.) in the Wheeler collection.

80. *Pheidole* (*Pheidole*) *guilelmi-mülleri* Forel subsp. *mamore*, subsp. nov.

Soldier. Length 4.75 mm.

Head, excluding mandibles, a little longer than broad, slightly narrowed in front, with nearly straight sides, broadly rounded occipital corners and deeply, narrowly concave border. Clypeus convex, the carina short and thick; anterior border nearly straight. Mandibles short, very thick and blunt, the blade without teeth. Frontal carinae broad at base; antennal grooves longer than scapes. Scapes extending a little more than half the distance from eyes to occipital corners. Club shorter than remainder of funiculus; funicular joints 2–7 as long as broad. Eyes small and convex, located at sides of head at anterior third. Pronotum transverse, the sides extended into blunt cones. Promesonotal impression feeble. Mesonotum flat anteriorly; with a narrow transverse depression before the basal margin, which is somewhat elevated; declivous behind. Epinotum broadly depressed at base, the spines very stout, triangular and strongly diverging. Petiolar node in profile wedge-shaped; from above twice as broad as long. Postpetiole three times as broad as the petiole, conical at sides. Gaster elliptical. Legs short, femora and tibiae thickened.

Head subopaque, coarsely striate, striae extending over occiput; clypeus with several coarse punctures anteriorly. Mandibles subopaque; coarsely, sparsely punctate. Thorax subopaque with transverse, interrupted rugae. Epinotum sublucid, with a few fine transverse striae. Petiole and postpetiole closely, finely punctate. Gaster finely punctate, sublucid. Legs shining. Head, antennae, body, and legs with abundant long, rather stiff pile.

Color black, except the legs and apex of antennae which are castaneous.

Worker. Length 2.55 mm.

Head, excluding mandibles, as broad as long; sides and occipital margin evenly rounded. Mandibles long, slender, with three teeth apically. Clypeus slightly convex; anterior border truncate. Antennal scapes extending half their length beyond the occiput. Prothorax rounded, elevated. Promesonotal impression indistinct. Mesonotum in profile convex above, declivous behind. Epinotum flat and narrow above, the sides and posterior border slightly margined; the spines barely perceptible. Node of petiole in profile rounded above. Postpetiole a little broader than long, with rounded sides. Legs long, the femora and tibiae somewhat swollen. Minutely punctate and shining. Base of epinotum transversely carinate. Pilosity as in the soldier.

Color fuscous; petiole, postpetiole, and legs testaceous fuscous.

Female. Length 5.5 mm.

Head, excluding mandibles, broader than long, sides slightly convex; border of occiput only slightly concave. Mandibles similar to those of soldier. Antennae short, scapes extending three fourths the distance to occiput. Eyes large, located in front of middle of head. Other characters as in the soldier. Thorax flattened above, declivous in the epinotal region, the epinotal spines short and stout. Postpetiole twice as broad as the petiole, the sides drawn out into distinct cones. Gaster one and one half times length of head. Sculpture of head similar to that of the soldier. Pro- and mesothorax longitudinally striate. Epinotum sparsely and coarsely punctured. Gaster with fine punctures, shining.

Wings. Length a little over 5 mm. Slightly infuscated. Veins light fuscous.

Described from workers, soldiers, and a single female from a colony taken at Madeira-Mamoré Camp 36. This is a very distinct form, the soldier differing from that of typical *P. guilelmi-mülleri* in its smaller size, darker color, stronger cephalic sculpture, and in being much less shining. The worker is more shining and much darker than the soldier. It is much smaller than the closely related *P. hohenlohei* Forel from Brazil. The very minute epinotal spines of the worker are scarcely more than angles of the margin at the bases.

81. *Pheidole (Pheidole) wheeleri*, sp. nov.

Plate 3, fig. 23.

Soldier. (Plate 3, fig. 23). Length 3.5 mm.

Head, excluding mandibles, a fourth longer than broad, narrowed in front, with slightly convex sides, broadly rounded occipital corners and narrowly excavated border. Mandibles thick, blunt at apex, with one blunt subapical tooth. Clypeus flat, without a keel; the anterior border at middle rather strongly bisinuate. Frontal area large, triangular. Frontal carinae moderately elevated at base, nearly straight, diverging, extending as far as apex of antennal scapes. Antennal scapes slightly bent at base, thickened at apex; reaching to half the distance between eye and occipital corners. Funiculus short and thick, the club as long as the remainder; first joint twice as long as broad, joints 2–7 broader than long, joints 8–9 longer than broad; apical joint of club as long as the two preceding together. Eye small, flat, located at sides of anterior third of head. Pronotum twice as broad as long, in front narrow and flat; sides from above drawn out into strong conical projections, in front of which the straight side margins converge to the flattened portion. Promesonotal suture discernible, but not impressed. Mesonotum flat above to the posterior fourth, where it is declivous. Mesoëpinotal suture broad and deep. Base of epinotum longer than the declivity, narrowly excavated longitudinally; the sides rounded; base strongly depressed; spines stout, erect, half as long as the base. Petiolar node wedge-shaped in profile; from above, more than twice as broad as long. Postpetiole transverse, one and a half times as broad as the petiole, the sides bluntly conical. Gaster short and oval. Legs short, the femora very much swollen; tibiae thickened at anterior half.

Body, except epinotum, head, mandibles, antennae, and legs shining. Mandibles with very distinct, regular, scattered punctures; clypeus smooth and shining. Cheeks and sides of the anterior portion of front longitudinally striate, the striae short, extending to about opposite the eyes; the spaces between shining. Front with rather strong, regular, widely separated punctures. Pro- and mesonotum with sparse punctures; the conical lateral pronotal projections densely punctate at apex. Epinotum sublucid, shallowly granulosely punctate. Petiole, postpetiole, and gaster sparsely punctate, the posterior portion and sides of the postpetiole transversely rugulose.

Head, mandibles, antennae, body, and legs with rather abundant long silky pile.

Color dark reddish brown, gaster, epinotum, and a spot on the vertex much darker than the rest.

Worker. Length 2 mm.

Head, excluding mandibles, a little longer than broad, as broad in front as behind, with moderately convex sides and nearly straight occipital border. Mandibles long and slender, with long apical and subapical teeth. Clypeus convex, flattened anteriorly, the border concave at middle. Antennal scapes scarcely surpassing the occipital corners; all the funicular joints longer than broad. Eyes little convex; situated at middle of sides of head. Structure of thorax and abdomen similar to that of soldier. Sculpture and pilosity similar to that of the soldier, but the mesonotum is more closely punctate.

Color dark reddish brown throughout.

Described from soldiers and workers taken at Madeira-Mamoré Camp 39. The strongly prolonged sides of the pronotum, which, with the mesonotum, forms a diagonal quadrangle from above, is very characteristic. Both soldier and worker are very brightly shining, with the exception of the epinotum. The punctation of the head and especially that of the mandibles is coarse.

82. *Pheidole* (*Pheidole*) *carapuna,* sp. nov.

Plate **3**, fig. 22.

Soldier. (Plate **3**, fig. 22). Length 3.24 mm.

Head, excluding mandibles, one and a fourth times as long as broad, as broad in front as behind, with slightly convex sides and deeply, narrowly excavated border. Mandibles long and thick, the blade with a large subapical tooth, a large tooth near base and feeble denticles between. Clypeus depressed at sides and anteriorly, with a strong, narrow carina at middle and one on each side, the border rounded. Frontal carinae extending about half as far as the tips of antennal scapes. Eyes small, flat, located at anterior third of sides of head. Antennal scape slightly bent at base, thickened at apex, extending half the distance to occipital corners. Funiculus short, the first joint three times as long as thick; joints 2–8 as broad as long; club as long as the rest of the funiculus with the first two joints subequal, apical joint longer than the two preceding, connate. Pronotum and mesonotum in profile rounded, the sides of the former extended at the sides in the form of a blunt cone. Promesonotal suture basally discernible. Epinotum at base strongly, broadly impressed for its entire length, the spines short, triangular and erect. Petiole thick, the node as deep as thick, from above one and a half times as long as broad; postpetiole from above transverse, narrowly rounded at sides. Gaster oval, short. Legs moderately long.

Sublucid. Mandibles shining, with sparse fine punctures at base. Front of head and cheeks with strong parallel striae, which become confused and disappear toward the vertex, where they are replaced by dense granulose punctation; this granulation extends forward, outward from the frontal carinae to the cheeks. Clypeus strongly, but more sparsely striate and shining. On the front and cheeks the spaces between the striae are smooth and shining; the occiput is very shining. Thorax and epinotum granulosely punctate. Node of petiole and postpetiole and base of first gastric segment with sparse, more shallow punctures; rest of gaster smooth and shining.

Head, thorax, and abdomen with long hairs, which are most abundant on the gaster. Sides of head in front sparsely pilose; antennae and legs with semierect hairs.

Worker. Length 1.5 mm.

Head, excluding mandibles, a little longer than broad, with slightly convex sides, broadly rounded occipital corners, and very slightly, narrowly concave border. Mandibles long, slender, the blades minutely denticulate. Clypeus convex, the anterior border rounded. Frontal carinae short, parallel. Antennal scapes surpassing the occipital corners by about one sixth of their length. Eyes large and convex, located at middle of sides of head. Thorax in profile rather low, evenly rounded. Promesonotal suture not discernible. Mesoëpinotal suture deeply impressed. Epinotum with equal base and declivity, the former depressed; spines very short, triangular. Petiole and postpetiole similar to those of worker.

Head, thorax, and epinotum subopaque; coarsely, densely granulose; cheeks with a few coarse striae. Petiolar node punctate; postpetiole and gaster smooth and shining. Head and body with sparse, fine hairs.

Color testaceous.

Female. Length 4 mm.

Head, excluding mandibles a little longer than broad, slightly narrowed in front, with feebly convex sides, shallowly excavated border. Mandibles and clypeus as in soldier. Antennal scapes extending three fourths the distance to occipital corners. Eyes large and convex, situated at anterior third of head. Ocelli large, arranged in a triangle. Epinotal spines shorter than in the soldier. The rest similar to the soldier, with the usual sexual differences.

Sculpture of head similar to that of soldier, except that the coarse striae extend onto the vertex and occiput. Thorax smooth and shining. Epinotum transversely striate. Nodes and a space at the base of the first gastric segment granulously punctate. Pilosity as in the soldier.

Color dark fuscous, cheeks and clypeus lighter. Antennae and legs testaceous. Wings strongly infuscated; veins and stigma fuscous.

Described from several workers and a single female collected at Madeira-Mamoré Camp 39. The color of the soldier is striking. The head is rich reddish brown, darker on the vertex and front and lighter on the cheeks and clypeus. The mandibles are a rich red wine-color. The thorax and epinotum are dark fuscous, the gaster is similarly colored, but with the first segment lighter basally. This species approaches *P. susannae* Forel from which it differs in the much longer and differently sculptured head, the feeble promesonotal impression, and in color.

83. *Pheidole* (*Pheidole*) *triconstricta* Forel var. *laidlowi*, var. nov.

Soldier. Length 3.5 mm.

Head, excluding the mandibles, a little longer than broad, slightly broader in front than behind; posterior corners rounded; occipital margin rather deeply impressed; occiput at middle with a deep impression which extends to clypeus, becoming shallow anteriorly. Frontal carinae more than half the length of the scape, sharply defined. Eyes at sides of the anterior third of head. Mandibles convex, bidentate, the teeth thick and subequal. Clypeus trapezoidal, flattened, truncate in front and behind, with a narrow median impression from middle of front extending two thirds the distance to base. Frontal carinae diverging behind. Antennal scapes reaching three fourths the distance to occiput. Antennal club a little shorter than the rest of the funiculus, funicular joints 2–7 broader than long. Prothorax rounded above, sides a little in front of middle drawn out angulately. Promesonotal impression distinct. Mesonotum seen from above trapezoidal, narrowed in front, deeply, transversely constricted at middle, the posterior portion elevated into a ridge. Mesoëpinotal constriction deep and broad. Base of epinotum as long as declivity, deeply concave; on either side with a high ridge which terminates in an acute, erect spine, about two thirds as long as the base. Petiole twice the length of postpetiole, the node broader than long, with conical sides; seen from the side concave in front, higher than postpetiole. Postpetiole broader than long, the sides conical.

Gaster smaller than the head. Legs slender. Head and gaster shining, thorax and petiole subopaque. Mandibles very finely punctate. Head densely, minutely punctate. Thorax, petiole, and postpetiole with more dense punctures. Legs finely punctate, shining.

Thorax without hairs, head, petiole, and gaster with sparse, scattered erect hairs.

Color pale brownish yellow, mandibles dark ferruginous.

Worker. Length 2 mm.

Head, excluding the mandibles, a little longer than broad, with convex sides and evenly rounded posterior margin. Eyes at sides of head in front of middle. Mandibles with two very acute teeth. Antennal scapes extending one third their length beyond the occipital margin. Thorax similar to that of the soldier, but the prothorax more rounded at sides. Epinotum, petiole, and postpetiole similar to those of soldier. Gaster as large as head.

Head, legs, and gaster shining, the rest of the body opaque.

Pilosity and color like those of the soldier. The hairs are even sparser. Mandibles and border of clypeus darker.

Described from several soldiers and workers from Madeira-Mamoré R. R. Camp 37.

Differing from the typical form in the smaller size, and pale color. The antennal scapes of the soldier are proportionally longer, reaching three fourths the distance to corners of occiput.

Named after Dr. James Laidlow, of the medical corps of the Madeira-Mamoré Railroad.

84. *Pheidole* (*Pheidole*) *biconstricta* Mayr.

Manaos, Porto Velho, Abunã and Camps 39, 41, 43 Madeira-Mamoré R. R.

On the Rio Madeira this species was very common, nesting in or beneath rotten logs. The colonies are very populous.

85. *Pheidole* (*Pheidole*) *biconstricta* subsp. *bicolor* Emery.

Madeira-Mamoré R. R. Camp 39.

86. *Pheidole* (*Pheidole*) *biconstricta* subsp. *burtoni*, subsp. nov.

Plate 3, fig. 24.

Soldier. Length 6 mm.

Head, excluding mandibles, a little longer than broad, much narrowed in front, with convex sides, narrowly rounded occipital corners and deeply and narrowly excised posterior border. Mandibles thick, the blade with five short, very blunt teeth and a large subapical tooth. Clypeus rather flat, feebly carinate; anterior border strongly excised at middle. Frontal area large, triangular, impressed. Frontal carinae a third as long as antennal scapes. Antennal scapes broadly rounded at base, somewhat thickened apically, extending less than half the distance from the eyes to posterior corners of head. Club as long as the remainder of funiculus; funicular joints 2–7 as long as broad. Eyes small, convex, located at sides of anterior third of head. Pronotum similar to that of *P. biconstricta*, but the corners are somewhat more angulate. Mesonotum slightly convex above, with feeble transverse impression posteriorly. Base of epinotum much less impressed than in *P. biconstricta*. Petiolar node and postpetiole broader than long; the latter conical at sides.

Subopaque, except the occipital corners, mandibles, and clypeus, which are shining. Mandibles strongly striate at base and regularly punctate throughout. Head coarsely shagreened, coarsely longitudinally rugose between the frontal carinae. Vertex and occiput with foveolate punctures. Thorax and abdomen shagreened, the gaster more shallowly than the rest. Legs finely punctate. Each of the foveolate punctures on the head bears a short, stiff, recumbent hair. Body, antennae, and legs throughout with long, stiff pile.

Head, posterior portion of pronotum, and epinotum piceous; mandibles and clypeus red, the rest castaneous, the gaster distinctly lighter than the other parts.

Described from a single soldier taken at Porto Velho. The sculpture of the head is very different from the other forms of *P. biconstricta* and the transverse mesothoracic impression is broader and more shallow.

87. *Pheidole* (*Pheidole*) *fallax* Mayr subsp. *emiliae* Forel.

Several soldiers and workers were taken at Manaos.

88. *Pheidole* (*Pheidole*) *fallax* subsp. *jelksii* Mayr.

Found at Abuná, Bolivia, and at Porto Velho, Brazil.

89. *Pheidole* (*Pheidole*) *fallax* subsp. *jelskii* var. *antillensis* Forel.

Several workers and soldiers from Pará and Abuná, Bolivia agree closely with West Indian specimens before me.

90. *Pheidole* (*Pheidole*) *impressa* Mayr.

Two soldiers of this curiously colored species were taken at Baixa Verde. Since the types were described from Baturité in Ceará, the species has not been recorded. My soldiers differ a little in color from those described by Mayr, but otherwise agree closely with his description. The head is ferruginous instead of ochre-yellow and the gaster black. It may be that the Baixa Verde specimens represent an undescribed color variety, but I think it more probable that those before Mayr were more immature and the color not fully developed.

91. *Pheidole* (*Pheidole*) *wallacei*, sp. nov.

Soldier. Length 6 mm.

Head, excluding mandibles, longer than broad, narrowed behind; sides slightly convex; occipital corners narrowly rounded, the border with a shallow, narrow incision. Mandibles large and stout, the apical tooth long; blade with a short, stout subapical tooth and several very small teeth. Clypeus depressed; anterior border distinctly concave at middle. Frontal carinae strong and thin at base, extending only slightly past the antennal pits. Frontal area strongly depressed. Antennal scapes slender, extending almost to occipital corners, moderately bent at base; funiculus long and very slender, the first joint somewhat swollen, joints 2–8 cylindrical, three times as long as broad; club very slender, a little more than half as long as the rest of funiculus, the joints about four times as long as broad, apical joint a little longer than the penultimate. Eyes small, convex, located at anterior third of head. Pronotum in profile evenly rounded; the sides slightly drawn out and rounded a little posterior to the middle. Mesonotum in profile angulate at middle, the anterior part flat, the posterior declivous. Base of epinotum much longer than the declivity, flat anteriorly, narrowly impressed posteriorly; spines triangular, the width at base greater than the height. Petiolar node twice as broad as long, in profile triangular. Postpetiole one and a half times as broad as long, narrowly rounded at sides. Gaster short, oval. Legs very long and slender.

Head shining; cheeks and front with widely separated rugae, which extend only slightly posterior to the eyes; front and vertex with sparse, distinct punctures. Mandibles sublucid, very coarsely and sparsely punctured at base. Thorax, epinotum, petiole, and postpetiole with sparse interrupted transverse rugae; the spaces between the rugae shining. Gaster finely punctate, shining. Funiculus sparsely pubescent, head, body, antennae, and legs with long hairs.

Color ferruginous; anterior border of head and the mandibles brownish red. Pile golden yellow.

Worker. Length 5 mm.

Form very long and slender. Head, excluding mandibles, much longer than broad, strongly narrowed behind to form a distinct neck, the posterior border of which is broadly expanded and elevated. Mandibles long, acuminate at tip, with a long subapical tooth and several shorter teeth. Clypeus depressed in front, the border strongly concave at middle. Frontal carinae subparallel, extending to opposite the anterior border of eyes. Eyes large and convex, situated at sides of front, anterior to the middle of head. Antennae very long and slender, the scapes about twice as long as the head including the neck; funicular joints similar to those of worker. Pronotum longer than broad, strongly narrowed in front; broadest behind middle; the pleurae extended behind into small elongate tubercles. Promesonotal suture strongly impressed. Mesonotum longer than broad, little convex. Mesoëpinotal impression broad and deep. Base of epinotum distinctly longer than the declivity, rounded above; spines very short, triangular, erect, located closer together than their distance from the sides. Petiolar node one and a half times as long as broad, triangular in profile. Postpetiole longer than broad, with rounded sides. Gaster oval. Legs very long and slender.

Sublucid. Cheeks with distinct, widely separated rugae. Front and vertex sparsely punctate. Mandibles sublucid, finely punctate. Pronotum in front with very sparse, transverse rugae, the rest of thorax and the abdomen finely punctate. Pile similar to that of soldier, but more sparse.

Color light ferruginous, anterior border of head, the mandibles, and the antennal club darker.

Described from several workers and soldiers, Madeira-Mamoré Camps 39 and 46. This very distinct and striking species is related to *P. bergi* Mayr and *P. oxyops* Forel, but is quite distinct from either. From *P. bergi* the soldier differs in the much longer antennal scapes, the more slender club, the differently shaped epinotum, which in *P. bergi* is broadly depressed, and in the much smaller size of the epinotal spines. *Pheidole wallacei* is a larger and more slender species.

The structure of the worker's head, long drawn out behind, and the very slender thorax and epinotum, and the small size of the spines distinguish it from the worker of *P. bergi*. The worker of the latter species has the meso- and epinotum granulously punctate and subopaque instead of smooth and shining as in *P. wallacei*. The worker has extremely long legs. Those which I observed were on the ground and entering a hole beneath a tree, where the nest was probably located.

92. *Pheidole* (*Pheidole*) *opaca* Mayr.

Numerous workers, soldiers and females from Pará, Abuná, and Madeira-Mamoré Camp 39, where it occurred commonly in populous colonies beneath logs.

93. *Pheidole* (*Pheidole*) *fimbriata* Roger.

A single soldier of this characteristic species was found at Ceará-Mirim, and a female at Madeira-Mamoré Camp 39.

94. *Pheidole* (*Pheidole*) *flavens* Roger.

Natal, Ceará-Mirim, Independencia, and Pará.

95. *Pheidole* (*Pheidole*) *flavens* subsp. *exigua* Mayr.

Taken at Ceará-Mirim and Independencia.

96. *Pheidole* (*Pheidole*) *colobopsis*, sp. nov.

Plate **3**, figs. 25, 26.

Female (deälated). Length 4 mm.

Head, excluding mandibles, a little longer than broad; broadest in front, with nearly straight sides, concave occipital border and narrowly rounded corners; anterior corners right-angled. Vertex slightly rounded above, a little longer than the front. Front separated from vertex by a distinct angle, and forming with the mandibles a disc; very strongly impressed with a deeper, longitudinal groove at middle. Frontal area small, triangular, more deeply impressed than the front. Clypeus deeply impressed at middle; the anterior margin carinate at middle, broadly crenulate. Frontal carinae strong, extending sinuately to ends of antennal scapes. Mandibles very short and thick, the blade slightly concave, edentate. Antennae short, the scape extending a little more than half the distance to occipital corners, strongly geniculate at the angle which separates front from vertex, thickened distally. First funicular joint as long as the two succeeding joints, joints 2–8 as long as broad; joints 9–11 forming a club as long as remainder of funiculus. Eyes large, oval, flat, with distinct ommatidia; situated at sides in front of middle. Antennal fossae deep; extending to apex of scape. Ocelli distinct, the median much the largest, each situated in a foveole, the median of which is extended forward as a groove. Thorax rather flat above, sides rounded; mesothorax a little longer than broad; scutellum rounded behind. Epinotum with subequal base and declivity; the base strongly concave at middle, with elevated sides, which terminate in short thick, acuminate spines; surface of declivity concave, but less so than the base. Petiole elongate; the node transverse, in profile narrowed above, constricted behind. Postpetiole twice as broad as petiole, the sides produced into angles, rounded in front, constricted behind; in profile evenly convex above. Gaster oval, broad at apex.

Shining, with abundant silky pilosity, which is partly recumbent on gaster and erect on the other parts of body. Cheeks, front, and clypeus devoid of hairs. Vertex longitudinally, crenulately striolate, front and clypeus with striolae arranged in a concentric pattern. Mandibles with five transverse, diagonal carinae. Thorax, petiole, and postpetiole minutely punctate; postpetiole above with five short longitudinal carinae.

Color testaceous; mandibular blades and posterior margins of gastric segments darker. Pilosity yellow.

Described from a single female taken at Madeira-Mamoré Camp No. 41. It was beneath a log, in company with a colony of *Myrmicocrypta foreli*. This is the first known South American Pheidole belonging to the group of species which have the front of the head depressed and disc-like, somewhat similar to that of the major worker in Camponotus subgenus Colobopsis.

97. *Crematogaster* (*Crematogaster*) *stolli* Forel.

This very distinct species was abundant at all the localities visited along the Rio Madeira. The covered galleries that it constructs superficially resemble termite runways, but are built of fibrous material. They extend along tree trunks, often in an irregular spiral direction around the tree and branching to the limbs. The nest varies from hemispherical to broad and flat, up to five or six inches in width, though generally smaller. The brood-chambers are in deep cavities. The acrid secretion from the anal glands of *C. stolli* is much more pungent than that of any other Crematogaster which I have observed.

98. *Crematogaster* (*Crematogaster*) *stolli* subsp. *autruni*, subsp. nov.

Worker. Length 4.5 mm.

Head, excluding mandibles, a little broader than long, as broad in front as behind, with rounded sides, broadly rounded occipital corners; the occipital border nearly straight, but narrowly concave at middle. Clypeus about as broad as long, with slightly rounded surface and broadly rounded anterior border. Mandibles short and stout. Frontal carinae feeble, but distinct, extending to opposite the eyes, which are located at middle of sides of head. Eyes small and flat. Antennae short and stout, the scapes arcuate, much thickened distally, extending about two thirds the distance to occipital corners. First funicular joint as long as the two succeeding joints taken together; joints 2–7 as long as broad. Pro- and mesonotum together as broad as long, evenly rounded above and at sides. Epinotum with subequal base and declivity, the base rounded in profile, the surface of base concave. Spines moderately long and stout. Petiole in profile about twice as long as broad; from above, flattened and two thirds as broad as long. Postpetiole elongate, rounded. Legs stout. Gaster of medium length, triangular.

Body sublucid. Head in front with sparse, fine punctation; cheeks, sides of head and a space parallel to the frontal carinae densely striolate. Mandibles rugosely striolate, with a few fine recumbent white hairs. Antennae punctate, the funiculus with considerable fine, recumbent pile. Promesonotum finely rugulosely punctate, with a few very fine hairs. Epinotum and mesothoracic pleurae coarsely striolate. Petiole and postpetiole rugosely punctate. Gaster subopaque, densely punctate, with a few erect black hairs.

Color black, except the head, which is somewhat reddish.

Described from six workers taken near Manaos. This form, which is named after Don Antonio Autrun, our genial host at Kete Purangi, differs from *C. stolli* in the shorter antennal scapes and in sculpture and color, besides being smaller. The epinotal spines are shorter and thicker and the head and thorax lack the long, erect hairs of *C. stolli*. I am in doubt whether *C. autruni* should not be considered as specifically distinct rather than as a subspecies.

99. *Crematogaster* (*Crematogaster*) *heathi*, sp. nov.

Plate 3, fig. 27.

Worker. Length 2.5 mm.

Head about as broad as long, with slightly convex sides and broadly rounded occipital corners; occiput faintly excavated. Eyes small, little convex, located at sides of head slightly posterior to middle. Mandibles short and stout, the blade strongly concave. Antennal sçape not reaching the occipital corners; funicular joints, except those of the club, subglobose, as broad as long. Clypeus quadrate, as broad as long, the anterior border broadly rounded. Prothorax subglobose; pronotum as broad as long, with narrowly rounded sides, so that the disc is transversely oval, broadly rounded above. Epinotum with a very short base, which is narrowly rounded, giving in profile the appearance of a tubercle; the declivity is three times as long as the base, with a broad, flat surface, on either side of which is a strong spine curving outward and upward. Petiole flattened above, not quite so broad as long, with straight posterior margin; postpetiole subglobular. Gaster short and broad, triangular.

Head shining, minutely punctate throughout, the front with sparse, coarse punctures. Thorax, petiole, postpetiole, and legs sublucid. Gaster subopaque, densely punctate. Head and thorax, petiole and postpetiole in front sparsely pilose, the pile fine and recumbent. Antennæ, legs, and abdomen with erect pilosity.

Color red, except the gaster, which is black, and the legs, which are somewhat infuscated. Pile and pubescence yellowish.

Described from a large number of workers taken from twigs at Independencia. This species is related to *C. brevispinosa* from which it differs in the structure of the epinotum and in the absence of teeth on the mandibular blades. In living specimens the black color of the gaster is in vivid contrast to the red of the other parts.

100. *Crematogaster* (*Crematogaster*) *brevispinosa* Mayr.

Several colonies of this well-marked species were taken at Itacoatiara and Abuná, Bolivia.

101. *Crematogaster* (*Crematogaster*) *brevispinosa* subsp. *rochai* Forel.

This is common at Natal and Baixa Verde, where numerous colonies were found. The workers agree closely with cotypes from Ceará.

102. *Crematogaster* (*Crematogaster*) *victima* F. Smith.

Many colonies were found in hollow twigs at Natal, Baixa Verde, Independencia, Pará, and Madeira-Mamoré Camp 39.

103. *Crematogaster* (*Crematogaster*) *sulcata* Mayr.

Abuná, Rio Madeira.

104. *Crematogaster* (*Crematogaster*) *limata* F. Smith.

Common at Manaos and Porto Velho. A colony at the latter locality was nesting in a leguminaceous pod.

105. *Crematogaster* (*Crematogaster*) *brasiliensis* Mayr.

Manaos and Porto Velho.

106. *Crematogaster* (*Crematogaster*) *longispinosa* Emery.

Many workers were taken at Abuná.

107. *Crematogaster* (*Crematogaster*) *acuta* (Fabricius).

Many workers are in the collection from Madeira-Mamoré Camp 39.

108. *Monomorium* (*Mitara*) *subterraneum*, sp. nov.

Plate **4**, figs. 29, 30.

Worker. (Plate **4**, figs. 29, 30). Length 3.5 mm. to 5 mm.

Head, excluding mandibles, as long as broad, nearly as broad in front as behind, with convex sides and feebly concave occipital border. Eyes small, located at sides of head, a little posterior to the middle. Clypeus very convex, unarmed, the anterior border somewhat concave. Frontal carinae short, straight. Antennae 11-jointed; scapes extending a little past the occipital corners of head; first funicular joint longer than broad and nearly twice the length of the second, which is a little longer than broad; joints 3–7 as broad as long; joints 8–10 forming an elongate club, almost as long as the rest of funiculus, the apical joint of which is longer than the two preceding together. Mandibles rather thick, the blade with five strong teeth. Pronotum transverse, convex above and at sides, broadest a little behind the middle. Promesonotal suture barely perceptible; mesoëpinotal impression strong. Epinotum in profile evenly rounded; the sides very feebly margined. Petiole slender, the node in profile deeper than thick, rounded above, convex at the anterior, flat at the posterior surfaces. Postpetiole transverse, subglobose. Gaster as long as thorax and epinotum, broadly oval. Legs long and slender.

Sublucid. Mandibles, sides of clypeus, and frontal carinae coarsely striate longitudinally; cheeks with strong concentric striae, which terminate at the carinae, the vertex with sparse irregular rugae, the rest of head and the thorax densely punctulate. Epinotum transversely, and the posterior surfaces of the petiolar and postpetiolar nodes longitudinally carinulate. Gaster shining, sparsely punctate. Apical half of funiculus pubescent; the rest without pubescence but abundantly pilose, the pile stiff and erect.

Color testaceous, with a fuscous blotch on the front and vertex.

Described from a number of workers from Madeira-Mamoré Camp 39. These were in the ground, beneath the base of a recently uprooted palm, about three feet below the surface.

In a recent paper (Ann. Soc. ent. Belg. 1913, **57**, p. 261) Emery has divided those species of Monomorium which have eleven-jointed antennae into three subgenera. Of these, *M. subterraneum* must be placed in Mitara, which hitherto has contained only African, Asiatic, and Australian species. The species in this subgenus have the clypeus entirely without denticles or carinae, the eyes developed, and the epinotum unarmed. *Monomorium subterraneum* is very different from any other of the American Monomoriums on account of these characters, and also because it is an unusually large species, with considerable variation in size between the largest and smallest workers. The small eyes, the abundant stiff hairs with which the body is covered, and the color, as well as the location in which the colony was found, indicate that this species is hypogaeic in habit.

109. *Megalomyrmex bituberculatus* Forel.

Many workers which agree closely with specimens from the Rio Purus, received from Forel, were taken at Manaos, Porto Velho, and Madeira-Mamoré Camps 39 and 41. This form, which is confined to the upper Amazonian region, attends Membracidae and the workers were generally found in company with these on shrubs in the deep forest. The nest is subterranean, the entrance nearly always at the base of a tree. The living insect is slow in its movements.

110. *Megalomyrmex wallacei*, sp. nov.

Plate 3, fig. 28.

Worker. (Plate 3, figs. 28). Length 5 mm.

Head, excluding mandibles, one and a third times as long as broad, broadest at clypeus, strongly narrowed above eyes, with slightly convex sides and straight occipital border, the latter distinctly, though narrowly, margined. Clypeus long and narrow, not separated from frontal area, the sides extending to outer bases of mandibles; anterior border projecting and narrowly rounded at middle. Frontal carinae distinct, elevated at insertion of antennae, parallel, extending to opposite anterior border of eye. Mandibles long and acuminate, the blade with four pointed teeth. Eyes large and very convex, situated at sides .of front of head, a little anterior to the middle. Antennae long and slender; extending about one third their length beyond the occipital corners. First funicular joint nearly twice as long as the second, joints 2–8 subequal, longer than broad, cylindrical, joints 9 and 10 subequal, each twice as long as the eighth and a little shorter than the apical. Thorax long and slender. Prothorax slightly rounded above, sides rounded. Promesonotal suture faint.

Mesonotum pyriform, flattened behind, with a feeble transverse impression at middle and a longitudinal impression in front, the sides slightly margined posteriorly. Epinotum in profile rather flat above; its base about twice as long as declivity, into which it passes at a broad rounded angle; surface of base broadly concave, that of declivity flat; base of declivity with broad, ear-shaped tubercles. Petiole one and a half times length of postpetiole, without anteroventral tooth; the node in profile as deep as broad, concave in front, rounded behind, with a constriction near apex. Postpetiole broader than petiolar node, rounded above, the anterior surface nearly straight; anteroventral border angulate in front, but without distinct tubercle or tooth. Legs long and slender.

Gaster shining, sparsely, regularly punctate; rest of body and the legs subopaque. Head and thorax rugulosely punctulate, a median, longitudinal surface on the front less so and more shining than the rest; front of head between frontal carinae and eye concentrically striolate. Mandibles shining, coarsely striate. Epinotum and petiolar node transversely striolate; postpetiole rugulose like the front of head. Body and legs everywhere with abundant erect hairs. Mandibles, funiculus, and antennal scapes with semierect hairs, last four funicular joints pubescent.

Color light ferruginous, pile and pubescence yellow.

Female (deälated). Length 6.5 mm.

Closely resembling the worker. The white ocelli are small, but distinct. The smooth surface on the front is shorter but more distinctly shining than in the worker.

Described from a single female and several workers found at Porto Velho. This species is near *M. iheringi* Forel, from which it differs in its larger size, the head more constricted behind, in the much larger size of the eye, and in the subopacity of the tegument, which in *M. iheringi* is shining.

111. *Tranopelta gilva* Mayr. var. *albida,* var. nov.

Several workers of a small variety of *Tranopelta gilva* Mayr were taken at Camp 39, Madeira-Mamoré R. R. These differ from var. *brunnea* Forel, the only form of which the worker is known, in the smaller size (length 1.5 mm.) and in the uniformly pale color which in the series before me is almost white, with a faint tinge of yellow.

112. *Solenopsis picea* Emery var. *subadpressa* Forel.

This variety, somewhat larger than the typical Costa Rican form, was described by Forel from specimens collected by Sr. Diaz da Rocha at Ceará. Specimens which agree well with cotypes in the Wheeler collection were taken at Porto Velho, Abuná, and Madeira-Mamoré R. R. Co. Camp 39.

113. *Solenopsis globularia* (F. Smith).

One colony with numerous workers and females was found at Natal. The large size and globular shape of the postpetiole distinguish this from related species.

114. *Solenopsis subtilis* Emery.

One small colony was taken at Manaos.

115. *Solenopsis geminata* (Fabricius).

Colonies of the typical form of this widely distributed species were found at Natal, Independencia, Baixa Verde, Itacoatiara, Manaos, and Porto Velho.

116. *Solenopsis geminata* (Fabricius) subsp. *medusa*, subsp. nov.

Plate **4**, fig. 31.

In a number of colonies from Ceará-Mirim and the Maranguapé mountains the largest headed of the soldiers differ from those of typical *S. geminata* in having the sides of head at the anterior corners broadly expanded, as shown in Plate **4**, fig. 31.

I can detect no character in the smaller soldiers and workers that will distinguish them from the same phases of *S. geminata*, but the difference between the largest soldiers is striking and constant and seems to be of subspecific value. It is probably a local race, limited to the east coastal region of Brazil.

117. *Solenopsis saevissima* (F. Smith).

Very abundant at Pará, Itacoatiara, and Manaos in Brazil and at Abuná, Bolivia. There can be no doubt that this species is the one described by Smith from specimens sent to him by Bates and of which the latter has given an interesting account in his Naturalist on the River Amazons. It is the common fire ant ("formigo do fogo" of the Brazilians) of the Amazonian region, where it occurs generally in cultivated districts and is a bad pest. The colonies are large and numerous and the individuals highly aggressive, and, because of their numbers and painful sting, very formidable.

Smith's name has long been included with the synonyms of *S. geminata*, and *S. saevissima* was redescribed as *S. pylades* by Forel, but from field observations, compared with the notes of Bates and Smith and compared with specimens of *S. pylades* determined by Forel I am certain that the name given by the former author applies to this species.

118. *Leptothorax* (*Goniothorax*) *echinatinodis* Forel subsp. *spininodis* Mayr.

Plate 4, fig. 36.

Many workers and males from colonies which were nesting in twigs at Independencia, Ceará-Mirim, and Manaos agree closely with Mayr's description, except that in the entire series before me the tips of the femora are distinctly infuscated.

The types of this species were taken from an egg-case of a species of Mantis from a doubtful locality.

119. *Tetramorium* (*Tetrogmus*) *simillimum* F. Smith.

Several workers of this tropicopolitan species were taken at Manaos.

120. *Wasmannia auropunctata* (Roger).

This is one of the most widely spread Neotropical ants. It was taken in Brazil at Natal, Independencia, Itacoatiara, Manaos, Porto Velho, Madeira-Mamoré Camps 39 and 41, and at Abuná, Bolivia.

121. *Cryptocerus* (*Cephalotes*) *atratus* (Linné).

Common throughout northern Brazil. Taken by the Expedition at Pará, Manaos, Itacoatiara, and on the upper Rio Madeira. The species nests generally in hollowed branches of high trees, though one nest was in the hollowed trunk of a small tree. It is omnivorous in habit, frequenting garbage and eating even carrion. Some dead macaws which I placed in the woods as bait for carrion-feeding insects were continually covered by *C. atratus,* to the exclusion of other insects. It is diurnal, and a striking form as it walks slowly about on tree trunks and logs. The hard spiny armor is sufficient to protect it from any ordinary enemy.

122. *Cryptocerus* (*Cephalotes*) *oculatus* (Spinola).

One colony from Pará.

123. *Cryptocerus* (*Zacryptocerus*) *clypeatus* (Fabricius).

This species was very common at all places along the Rio Madeira, and at Itacoatiara and Santarem. A large colony was found nesting in a hollow parasitic vine.

124. *Cryptocerus* (*Cryptocerus*) *umbraculatus* (Fabricius).

A colony found at Abuná, Rio Madeira was nesting in a hollow branch near the top of a recently felled tree.

125. *Cryptocerus* (*Cryptocerus*) *inaequalis,* sp. nov.

Worker. Length 5.25 mm.

Head broader than long, broadest behind the eyes; narrowed in front. Posterior margin straight, the angles projecting as lamellae, and broadly concave at apex. Sides and anterior corners of head evenly rounded. Anterior margin of clypeus deeply concave. Pro- and mesothorax together as broad as long; prothorax angulate at the anterior corners and with a pair of flat triangular teeth at posterior half of margin. Sides of mesothorax with a short slender spine at middle. Epinotum more than twice as broad as long, with two broad teeth at sides. Petiole and postpetiole subequal in width. Petiole with long, slender, backward curving spines. Spines of the postpetiole short and broad, projecting forward. Gaster broadly cordiform, very convex above; anterior third of sides broadly margined; excised at middle of anterior border.

Subopaque. Sparsely, foveolately punctate above, except the gaster, which is finely and densely punctate. Legs foveolately punctate. Each puncture bearing a glistening scale-like hair.

Color black, with the marginate portions of the head and gaster yellow, and the tibiae ferruginous.

Described from four workers from Abuná and Madeira-Mamoré Camp 41.

The very long, slender, and curved spines of the petiole, compared with those of the postpetiole, and the lamellate occipital corners, with the concave apices are characteristic of this species. It is related to *C. spinosus* but differs in the form of the spines, and the absence of pile on the dorsum.

126. *Cryptocerus* (*Cryptocerus*) *spinosus* Mayr.

One colony found at Porto Velho, Rio Madeira.

127. *Cryptocerus* (*Cryptocerus*) *pusillus* Klug.

Widely distributed throughout Brazil. Numerous specimens were taken at Ceará, running along the wires of a fence, in the posts of which they were nesting. At Manaos a colony was taken from a hollow twig.

128. *Cryptocerus* (*Cryptocerus*) *minutus* (Fabricius).

Nesting in twigs at Natal, Manaos, Itacoatiara, and Porto Velho.

129. *Cryptocerus* (*Cryptocerus*) *depressus* Klug.

This was the commonest species of the genus at Manaos.

130. *Cryptocerus* (*Cryptocerus*) *maculatus* F. Smith.

A few specimens were taken at Natal, and a colony was found in a hollow twig on a cajú tree at Abuná, Bolivia.

131. *Cryptocerus* (*Cryptocerus*) *multispinus* Emery.

A single worker from Abuná.

132. *Cryptocerus* (*Cryptocerus*) *cordatus* F. Smith.

A small colony from Porto Velho.

133. *Cryptocerus* (*Cryptocerus*) *complanatus* Guérin.

Plate **4**, fig. 35.

A colony of *C. complanatus*, originally described from Cayenne, was taken from a twig at Itacoatiara. The species belongs to the group containing *C. cordatus, C. spinosus,* and *C. inaequalis.*

Worker. Length 5 mm.

The head is as broad as long, margin of occiput only slightly concave, the corners broadly angulate, without spines; front narrower than occiput; sides in front of eyes convex. Thorax longer than broad. Sides of prothorax narrowly margined, nearly straight; anterior corners angulate. Mesothorax with short spine at sides. Epinotum three times as broad as long, with a blunt spine at middle and a longer one at apical corners. Spines of petiole and postpetiole curved backward, those of the petiole the largest. Abdomen cordate, without dorsal impression at base.

Body subopaque, coarsely punctate, each puncture with a short silvery hair.

Color black throughout.

Soldier. (Plate **4**, fig. 35). Length 6 mm.

The body is less hairy and more shining than in the worker. The transverse carina between the pro- and mesothorax is prominent at sides and more feeble on disc. The angles at anterior corners of prothorax are acute. Mesothorax with short, blunt spines at sides. Epinotum without spine at middle; the corners with a short, pointed spine. Spines of petiole and postpetiole similar to those of worker, but stouter.

Color black.

The worker agrees in outline with the Peruvian specimen figured by Emery (Bull. Soc. ent. Ital. 22, 1890, **22**, p. 75, pl. 9, fig. 6). The outline of the soldier is shown in Plate **4**, fig. 35.

134. *Cryptocerus* (*Cryptocerus*) *pilosus* Emery var. *fiebrigi* Forel.

Several workers and soldiers from Natal agree closely with the description and with cotypes of this variety received from Dr. Forel. This very distinct species has not been hitherto recorded from Brazil, but undoubtedly is widely distributed along the coast.

135. *Daceton armigerum* (Latreille).

There were several colonies of this species in the grounds of the Zoölogical Garden at Pará, where workers were often seen on the fences and trees. At Itacoatiara I found a very large colony nesting in a hollow standing tree.

136. *Acanthognathus ocellatus* Mayr.

Plate **5**, fig. 39.

Female. (Plate **5**, fig. 35). Length 3.5 mm.

Head cordate; excluding mandibles, twice as long as broad, with convex sides and deeply excised occiput. Eyes large, convex, situated at middle of sides of head. Ocelli small, convex, white in color. Clypeus longer than broad, its anterior border truncate. Antennae slender and short; the scape not attaining the occipital corners, bent and slightly thickened distally; first funicular joint two and a half times as long as broad; joints 3–9 scarcely longer than broad; last two much longer than broad, the apical nearly twice the length of penultimate. Mandibles nearly as long as head, slender, straight; apex with two long subequal teeth and a shorter tooth. On the inner side near the base is a curved process, which extends upward a little past the base. This is bidentate at apex. Pronotum very narrow; in profile flat. Mesonotum evenly rounded above and at sides. Scutellum rounded. Epinotum with base and declivity subequal in length, the angle bearing a pair of stout, acute spines. Petiole elongate, slender, the node globular. Postpetiole subglobose, about as large as the petiolar node. Gaster short and thick.

Head in front somewhat shining; genae and occiput smooth and shining. Mandibles finely punctate. Antennae and thorax subopaque, the latter coarsely, rugosely punctate. Scutellum with five feeble longitudinal carinae. Petiole, postpetiole, gaster, and legs finely punctate, shining.

Front of head and occiput, thorax, petiole, postpetiole, gaster, legs, and antennal scapes pilose.

Color ferruginous; the front of head, thorax, and gaster darkest, legs lightest.

Described from one female which was found with a solitary worker beneath a board on the ground at Pará.

137. *Strumigenys smithi* Forel.

A single worker from Pará is in the collection.

138. *Strumigenys schulzi* Emery.

A single female and several workers were taken at Pará, the type-locality.

139. *Atta cephalotes* (Linné).

Common throughout the forest regions, in enormous colonies. Numerous specimens were taken at Porto Velho, Abuná, and Madeira-Mamoré Camp 41.

140. *Atta sexdens* (Linné).

Many specimens were collected at Natal, Ceará, Independencia, Baixa Verde, Ceará-Mirim, Manaos, and Porto Velho.

This ant (the "sauba" of the Brazilians) ranges throughout the tropical portions of South America, and is by far the most important economically of all ants. It strips many cultivated plants of their leaves, is especially attracted to citrus species. It takes also dried vegetable matter, in particular farina, the staple food of Brazil. At Independencia, back of our house was a large pile of kitchen refuse, and this was visited nightly by hordes of workers, which collected particles of farina, bread, and other vegetable material.

All sizes of workers forage for leaves, generally at night, but also in late afternoons or on cloudy days. The smaller workers of this and the preceding species often ride upon a portion of a leaf which is being carried by a large one and this has given rise to the native belief that the larger workers are blind and are guided by the smaller ones.

141. *Acromyrmex* (*Moellerius*) *landolti* Forel.

Common at Natal and Baixa Verde.

This species was described from a specimen from Colombia, and Forel has since recorded it from Bahia, and Emery from Venezuela. At Natal and Baixa Verde nests were very common. At the entrance is built a turret of grass, from one to six inches in height. Through this run circular tunnels, which vary in number, from one to eight. From the entrance the tunnel runs perpendicularly to the first fungus-garden chamber. This is about three inches in diameter and from six inches to two feet below the surface. The colonies are rather small. Although on the watch for inquilinous insects I failed to find any spiders in the turrets, as reported by Emery (Ann. Soc. ent. France, 1888, ser. p. 66.) in nests at Caracas.

142. *Acromyrmex* (*Acromyrmex*) *coronata* (Fabricius).

Several colonies were found at Pará.

143. *Acromyrmex* (*Acromyrmex*) *aspersa* (F. Smith).

Common at Natal, Baixa Verde.

144. *Acromyrmex* (*Acromyrmex*) *octospinosa* (Reich).

Numerous workers were found at Itacoatiara.

145. *Acromyrmex* (*Acromyrmex*) *nigrosetosa* Forel.

One colony was found at Souza, near Pará.

146. *Acromyrmex* (*Acromyrmex*) *nigra* (F. Smith).

Several workers are in the collection from Itacoatiara.

147. *Acromyrmex* (*Acromyrmex*) *emiliae* Forel.

A few workers were found at Madeira-Mamoré Camp 39.

This large, opaque form is very distinct from the related species in having no tubercles on the epinotum.

148. *Trachymyrmex diversus*, sp. nov.

Worker. Length 4 mm.

Head, excluding mandibles, a little longer than broad, broader behind than in front, with convex sides, and pointed posterior corners; occipital margin slightly concave. Eyes convex, located in front of the middle of the sides of head. Mandibles with two large apical teeth and several fine ones basally. Anterior border of clypeus broadly rounded. Lobes of frontal carinae large, flattened, subtriangular, the carinae extending back as strong, converging ridges nearly to the occipital corners of the head. Antennal scapes distinctly thickened apically, extending about one third their length past the occipital corners; funicular joints all distinctly longer than broad. Occipital angles with one large, double spine, and anterior to these several small conical tubercles. Preorbital carinae extending backward toward, but not reaching the occipital corners of the head. Vertex with distinct ridges, which converge posteriorly. Lateral spine of pronotum long and stout, the apex excised to form two blunt tips, the anterior of which is higher than the posterior. Median spines very short, conical. Inferior spine two thirds as long as lateral spines, stout, the apex broadly rounded. Mesonotum with two pairs of lateral, subequal, stout spines, about one third the length of the prothoracic spines, strongly denticulate. Mesoëpinotal constriction rather strongly impressed. Epinotum with subequal base and declivity, meeting at obtuse angle; with a pair of short, blunt spines a little in front of the middle of base; apical spines short and conical. Petiole from above about as broad as long, very abruptly narrowed anteriorly into a short petiole; node with a pair of stout spines. Postpetiole as broad as long, twice as broad as petiole; the posterior border distinctly margined, with a flattened impression anterior to margin and the lateral borders with three strong tubercles, the two anterior short and triangular, the one posterior longer and blunt.

Gaster suboblong, broadest behind the middle; first segment with prominent lateral ridge. Tubercles small, blunt, few in number. Legs long, rather slender, without tubercles.

Mandibles faintly shining, with a few hairs; remainder of body opaque and finely granular.

Hairs ferruginous, sparse, very short, and depressed, except on the ventral surface of gaster, where they are longer and suberect.

Color ferruginous, the antennae and carinae of front and vertex darker.

Described from workers taken on the trunk of a palm at Abuná, Rio Madeira.

Most closely related to *T. oetkeri* Forel from Sao Paulo, but differing in the smaller size of the anterior pronotal spines, which in T. *oetkeri* are much longer than the posterior pair.

149. *Apterostigma branneri,* sp. nov.

Plate 5, fig. 37.

Worker. Length 5 mm.

Near *A. calverti* Wheeler. Head, excluding mandibles one and three fourth times as long as broad, with nearly straight sides, as broad in front as behind. Posterior portion convex, behind contracted into a rather short neck, the sides of which are straight, the posterior angles somewhat prolonged and the border between them truncate. Eyes convex, located a little behind the middle of sides of head. Clypeus twice as long as broad, with rounded anterior border. Mandibles with seven subequal teeth. Frontal carinae in front strongly lobed, behind these becoming very feeble, the posterior portion shorter than the lobes. Antennal scape extending nearly one half its length past the occipital corners, first funicular joint nearly as long as the three succeeding joints together; joints 2–9 broader than long. Thorax elongate. Pronotum with a moderately strong anterior border, which is slightly reflexed. Mesonotum with a pair of subparallel longitudinal ridges. Epinotum with similar ridges extending along base, and to base of declivity. In profile the declivity of the epinotum is nearly straight and about as long as the slightly convex base; the angle between the two surfaces rounded. Petiole from above less than twice as long as broad, sides convex, evenly narrowed anteriorly to the point of insertion. In profile the node is rounded, more than half as high as the length of the petiole. Postpetiole slightly broader than long, broadest a little behind the middle, the sides evenly rounded; posterior border very slightly convex. Gaster elliptical, without a longitudinal ridge on each side. Legs long, rather stout.

Mandibles feebly shining, finely longitudinally striate and sparsely punctate. Funiculus of antennae slightly shining, the rest opaque, very densely punctate.

Hairs abundant, long, suberect, dark at base, lighter towards apex. Pubescence very short.

Color dark brown, funiculus lighter.

Female. Length 5.25 mm.

Closely resembling the worker. The eyes are larger. Mesothorax without longitudinal ridges. Scutellum with two broad, blunt teeth. Base and declivity of epinotum equal, meeting to form an obtuse angle; base with faint parallel ridges. Wings opaque, dark fuscous, with an elongate black spot between branches of cubital vein. Rest as in the worker.

Male. Length 5 mm.

Head, excluding mandibles about one and one third times as long as broad, rounded at sides, behind more suddenly constricted than in the worker and female. Eyes and ocelli large, very convex. First joint of funiculus one third as long as second; second joint one and one fourth times as long as third; joints 3–11 subequal, two and one half times as long as broad. Prothorax in front constricted; seen in profile depressed; broadly margined. Mesothorax rounded, without longitudinal ridges. Scutellum with broad, flat teeth, as in female. Epinotum, petiole, postpetiole, and gaster similar to these parts in the female.

Pilosity abundant, black, suberect on the head and body, more depressed on the legs.

Wings. Length 4 mm.; fuscous, clouded with darker spots.

Color as in worker and female.

Described from specimens taken from two colonies at Abuná and Madeira-Mamoré R. R. Camp 39. *Apterostigma branneri* approaches most closely *A. calverti* Wheeler from Costa Rica, but *A. branneri* has the head distinctly longer, the pronotum less declivous in front, and without the deep impression posterior to the margin, and it lacks the distinct ridge on the propleurae; the angle between the base and declivity of the epinotum is much more obtuse. Seen in profile, the slope of the epinotal declivity is more gradual. The size of the worker of *A. calverti* is smaller (3.5–4 mm.).

150. *Myrmicocrypta foreli,* sp. nov.

Plate **4**, fig. 32–34.

Worker. Length 3.25 mm.

Head, excluding mandibles, about one fourth longer than broad, a little longer behind than in front, with slightly convex sides and concave occipital border, the occipital corners drawn out into thick blunt spines. Front broad and flat. Clypeus with broadly rounded anterior border. Frontal carinae somewhat elevated at base of antennal scape, anteriorly extending outward, almost attaining outer corners of the clypeus; posteriorly very slightly diverging towards occipital border, becoming much weaker at a little less than half the distance from base of scape to occiput. Antennal scapes curved, thickened at tips, extending one fourth their length beyond the occipital corners. Joints 3–8 of funiculus a little broader than long, gradually increasing in length towards apex; the basal joint of club one half as long as the terminal. Eyes small, located at the middle of sides of head. Mandibles long and rather slender with about seven short teeth on the blade, the penultimate and apical larger than the others. Pronotum concave at middle of front; on the side anteriorly with a sharp, minutely tuberculated crest; the median surface posteriorly with a pair of short, parallel tuberculated ridges, half as far apart as those lateral and anterior, extending half the length of the pronotum with a depression between them and the lateral margin; inferior spine short and acute. Promesonotal impression strong. Mesonotum lower than the pronotum but higher than the epinotum; at sides with a bidentate crest. Epinotum with subequal base and declivity, the latter very abrupt. Base margined with tuberculate ridges, which terminate in spines, which are stout, acute and about half as long as the declivity. Petiole elongate; the node globular, shorter than the distance to point of insertion. Postpetiole twice as broad as petiole, broader than long, sides evenly convex, posterior border truncate. Gaster elongate, broadest in front of apex of first segment. Legs long and stout.

Body and legs subopaque, except the gaster, the first segment of which is shining. Head with very small tubercles arranged in more or less circular patterns on the front. Mandibles longitudinally striate, sublucid. Body everywhere finely granular, with minute tubercles, which are coarser on the petiole, postpetiole, femora, and tibiae, and more scattered on the gaster.

Body, antennae, and legs with thick, short, curved, recumbent, glistening hairs.

Color light ferruginous, the blades of the mandibles darker.

Female (deälated). Length 4 mm.

Head similar to that of worker. Pronotum transverse, flattened above, the sides thinly margined, the margins projecting anteriorly as blunt lateral teeth. Mesonotum slightly rounded above, with a longitudinal pair of denticulated crests at sides and middle and between these a simple carina. The posterior border of scutellum extending into a pair of blunt spines. Epinotum with two long, strong spines at angle of base and declivity, which are equal. The rest similar to worker.

The color is somewhat darker, being light reddish brown.

Described from one female and several workers collected at Madeira-

Mamoré Camp 41. The colony was under a log, about three inches beneath the surface of the earth. A short perpendicular passage led to a single chamber in which was the small fungus garden.

151. *Cyphomyrmex rimosus* (Spinola).

Natal, Baixa Verde, Pará, Manaos, Abuná, Porto Velho, and Abuná, Bolivia.

Occurs in small colonies, beneath stones or in rotten wood. The death feigning instinct is strongly developed and the insect rolls up and remains inert for some time when touched.

DOLICHODERINAE.

152. *Dolichoderus* (*Dolichoderus*) *decollatus* (F. Smith).

This species occurs commonly throughout the greater part of tropical South America. A large series of workers, collected at Itacoatiara, Porto Velho, and Madeira-Mamoré Camp 39, shows a great deal of variation in color. Some have the head and thorax brownish red, in others these parts are entirely black. These forms are connected, by gradations.

Most of the workers that I observed were on the trunks of high trees. They are slow in motion, and have a habit of remaining motionless for many minutes at a time. When alarmed they drop to the ground.

153. *Dolichoderus* (*Dolichoderus*) *imbecillus*, sp. nov.

Plate **2**, fig. 18.

Worker. (Plate **2**, fig. 18). Length 10 mm.

Near *D. atellaboides*. Head, excluding mandibles and the neck, longer than broad, with convex sides. Occiput prolonged into a neck which in profile is nearly twice as long as thick and moderately reflexed at the posterior border. Mandibles slender, the blade with ten minute teeth and two larger coarser ones apically. Pronotum as broad as long, rounded above and at sides. Mesothorax similar to that of *D. atellaboides*, long and slender; in front with a small, rounded, elevated portion, on each side of which is a strong impression, extending backward and converging and terminating in tubercles at the posterior third. Epinotum elevated, in profile a little longer than deep, triangular; apex armed with a pair of strong, slightly curved spines; base and declivity subequal in length, the surface of the former convex, of the latter flat. Petiolar node in profile one and a fourth times thicker than long; from above twice as broad as long; the posterior surface sloping.

Sculpture similar to that of *D. atellaboides*, the head, pronotum, and epinotum sublucid; petiolar node very coarsely and densely rugose; mesothorax shining, less rugose; mesopleurae transversely striate.

Gaster finely punctate and shining. Mandibles punctate. The body, antennal scapes, and legs with rather abundant, erect, stiff hairs.

Color dark reddish brown to black, gaster black, legs lighter. Pile of body and legs grey to white, of antennal scapes, black.

Described from eleven workers taken at Manaos. They were feeding on the exudation of a small shrub along a trail in the forest.

This species is closely related to *D. atellaboides*, but differs in its smaller size and more slender form, the longer neck and petiolar node and the shining gaster. *Dolichoderus rosenbergi* Forel from Ecuador, also has the gaster shining, but the first antennal joint in four times as long as broad (in *D. imbicellus* it is less) and the size is larger (13 mm.).

154. *Dolichoderus* (*Dolichoderus*) *atellaboides* (Fabricius).

Several workers were collected at Abuná, and Madeira-Mamoré Camp 39. It is much less abundant than *D. decollatus*.

155. *Dolichoderus* (*Dolichoderus*) *imitator* Emery.

This is the smallest and most delicate species of the group, and the least common. Five workers were taken at Madeira-Mamoré Camp 39.

The following key serves to separate the Brazilian species of the subgenus Dolichoderus.

Occiput not prolonged into a distinct neck..................1.
Occiput prolonged into a distinct neck......................2.
1. Large, coarse species, epinotal spines long, acuminate; node flattened above, unarmed....................*decollatus* Smith.
Small, delicate species, finely sculptured, epinotal spines very

short; node in profile triangular, acuminate at apex, which is armed with two small teeth.................. *imitator* Emery.

2. Color black, petiolar node in profile flat above, twice as long as thick, epinotal spines rounded, slender.......... *rugosus* Smith.

Color, in part, red. Petiolar node in profile less than twice as long as thick, not flat above; epinotal spines somewhat flattened and slightly rugose toward base.....................3.

3. Node from above not twice as long as broad; gaster densely punctured and opaque..................... *atellaboides* Fabr.

Node from above more than twice as long as broad; gaster shining...4.

4. First antennal joint 4 times as long as thick; length 13 mm. (Ecuador).............................. *rosenbergi* Forel.

First antennal joint less than 4 times longer than thick; length 10 mm.................................. *imbecillus* Mann.

156. *Dolichoderus* (*Monacis*) *bispinosus* (Olivier).

Numerous colonies were found at Pará, Itacoatiara, Porto Velho, and Madeira-Mamoré Camp 39.

This is the commonest, and the most widely distributed species in the genus. It builds carton nests, sometimes of large size, in the branches of trees. The larger of these nests are solidly constructed, similar to certain *termitaria.* I am not certain that some which I examined were not termite nests that had been preëmpted by the ants. When the formicary is disturbed the workers defend it very pugnaciously. They bite hard enough to be disagreeable and the colonies are very populous. I have, on several occasions actually been driven from the near vicinity of a nest by this species.

157. *Dolichoderus* (*Monacis*) *spinicollis* (Latreille).

Workers of this singular species were encountered only once, at Madeira-Mamoré Camp 41. They were found shortly before twilight, moving in a file along a slanting tree-trunk and going up into a tangled mass of vines. Each was carrying in its mandibles a portion of some fluffy, waxy substance. I could not locate the nest, and did not see any more of the ants, though I returned to the same locality several times for further search.

This species is characterized by the very long, acute spines which project laterally and upward from the sides of the pronotum. The meso- and epinotum each has a stout, triangular spine at the posterior corners, and the node is armed at apex with a slender acuminate spine as long as the node. The whole body is covered with fine yellow pubescence.

158. *Dolichoderus* (*Monacis*) *laminatus* Mayr subsp. *luteiventris* Emery.

A female from Madeira-Mamoré Camp 41 agrees with Emery's description. It measures 5.5 mm. in length. The head, thorax, and petiole are black, and the gaster testaceous, each segment of the latter with a fuscous border. The legs are testaceous.

159. *Dolichoderus* (*Monacis*) *varians*, sp. nov.

Worker. Length 5 mm.

Near *D. lamellosus* Mayr. Head oval, excluding mandibles, a little longer than broad, the sides very convex; occipital angles narrowly rounded, the border narrowly concave. Clypeus flat above, with rounded anterior border. Frontal area very large, triangular. Frontal carinae thin, slightly elevated, extending to opposite posterior third of eye. Eyes small, convex, located in front of sides of head, a little behind the middle. Antennae slender, the scape thickened toward apex, extending a third its length beyond the occipital corners; all the funicular joints longer than broad. Pronotum transverse, broadest in front, the anterior angles drawn out to form acute triangular spines, which are flattened above; anterior border convex at middle, concave at sides; sides sharply but not broadly margined. Mesonotum one and a half times as long as broad, narrowed behind; the surface slightly concave; sides with a narrow elevated margin. Base of epinotum from above triangular, one and a half times as long as broad, sides roundly margined; apical portion transversely depressed and posterior to this elevated into a very thin lamella; declivity a little shorter than the base.

Petiolar node twice as broad as long; in profile twice as high as thick; anterior and posterior surfaces slightly convex, the apex rounded in front, behind elevated into a very thin broad lamella. Gaster short and thick.

Subopaque. Head, thoracic dorsum, and anterior surface of petiolar node shallowly, densely rugulose. Posterior surface of node and the gaster finely, densely punctate, the latter regularly granulose.

Body thickly covered with short, fine, erect pile. Antennae minutely pubescent.

Color black; antennae and legs ferruginous.

Described from a single worker taken at Porto Velho. In color and general form, as well as in sculpture *D. varians* resembles *D. lamellosus,* from which it differs in the shape of the mesonotum. In the latter species this is transversely oval, while in *D. varians* it is distinctly longer than broad, with a faintly crenulate border. *Dolichoderus varians* is also much more thickly pilose. The other closely related species, *D. laminatus,* has much narrower pronotal spines and finer sculpture throughout.

160. *Dolichoderus* (*Monacis*) *tristis,* sp. nov.

Plate 2, fig. 17.

Worker. Length 4.5 mm.

Head, excluding mandibles, a little longer than broad, narrowed in front, with slightly rounded sides and nearly straight posterior border; occipital corners broadly rounded. Clypeus rounded, the anterior border concave at middle. Frontal carinae nearly straight, subparallel, extending to opposite middle of eyes. Eyes small, feebly convex, located in front of sides of head a little behind the middle. Mandibles short and thick. Antennae short, the scape curved, thickened and flattened toward apex, extending less than one third its length beyond the occipital corners; funicular joints subequal in length, the first constricted at base, joints 3–10 cylindrical, about one and a half times as long as broad; joint 10 as long as broad; apical joint twice the length of penultimate. Pronotum transverse, narrower than head; the short neck transversely depressed; sides convex, acutely margined, the spines short and stout. Mesonotum transverse, sides margined. Epinotum campanulate, unarmed, flat above, the margin projecting laterally and behind; surface of basal portion rounded. Petiole from above transverse; in profile thicker than long, flat above, straight in front, concave behind; the posterior apical border with a short, thick, triangular spine which projects upward and backward; posteroventral surface extended into a triangular process. Gaster short and thick, considerably broader than the thorax.

Subopaque. Head regularly, rugosely punctate, each puncture bearing a short, recumbent glistening white hair. Cheeks and clypeus rugulose. Mandibles shining, coarsely punctured. Antennae densely punctulate. Thoracic dorsum finely punctate; pleurae shining; prothoracic pleurae densely punctate, meso- and epinotal pleurae rugose. Node shining, rugose. First gastric segment densely, irregularly striolate, the striolae longitudinal in front and transverse at the posterior border; remaining segments very densely striolate longitudinally. Legs somewhat shining, punctate.

Thorax and gaster finely pubescent and with scattered erect hairs. Legs sparsely pilose.

Color black; eyes, inner border of mandibles and tarsal joints reddish. Pilosity brownish.

Described from several workers taken at Abuná.

The curious structure of the petiole distinguishes this from the other species of the subgenus.

161. *Dolichoderus* (*Monacis*) *debilis* Emery.

Several workers from Madeira-Mamoré Camp 37 agree closely with cotypes received from Professor Emery.

162. *Dolichoderus* (*Monacis*) *debilis* Emery var. *rufescens* Mann.

The single colony of this very distinct variety was found at Madeira-Mamoré Camp 39, living parabiotically with *Odontomachus affinis* subsp. *mayi*. It differs from *D. debilis* in color, the greater length of the petiolar spines, and the coarse cephalic sculpture.

163. *Dolichoderus* (*Hypoclinea*) *abruptus* (F. Smith).

Many specimens were taken at Porto Velho, Abuná, and Madeira-Mamoré Camp 41. The workers were found most frequently on shrubs, where they attended Membracidae.

164. *Dolichoderus* (*Hypoclinea*) *lugens* Emery.

This species, originally described from Bolivia, swarmed in certain parts of the forest near Porto Velho, and at Abuná, Brazil and Bolivia. It forages on the ground more than do the other species of the genus, but like the others, nests in trees. The colonies must be very large, judging from the numbers of workers seen together. The workers are able to exude from the anal glands a large drop of a mustard-yellow secretion. This is not, so far as I could ascertain pungent, and it had no effect when applied to my skin.

165. *Dolichoderus* (*Hypoclinea*) *bidens* (Linné).

Taken at Pará, Porto Velho, and Abuná.

166. *Dolichoderus* (*Hypoclinea*) *bidens* (Linné) var. *inferior*, var. nov.

Taken at Itacoatiara and Abuná. This variety is somewhat smaller than typical *D. bidens*, and is light ferruginous in color. The punctation on the vertex is much finer.

167. *Dolichoderus* (*Hypoclinea*) *analis* Emery.

Several workers were taken at Pará and Abuná. It is less common than the preceding species.

168. *Dolichoderus* (*Hypoclinea*) *germaini* Forel var. *garbei* Forel.

Many workers from Ceará and Independencia agree with Forel's description of this variety from Bahia. The head has the sides little convex and much longer than broad; the pronotum is as broad as long. In all of the series the legs are light fuscous and in some of the specimens the thorax is considerably lighter than the rest of the body.

169. *Dolichoderus* (*Hypoclinea*) *ghiliani* Emery.

Plate 3, fig. 19.

Worker. Length 4.5 mm.

Head one and a third times as long as broad, with convex sides, rounded occipital corners and straight border. Clypeus rounded at middle, the anterior border broadly rounded. Mandibles long and thick, the blades finely dentate. Frontal carinae distinct, subparallel, not extending to opposite posterior border of eye. Eyes oval, situated on sides of front, a little anterior to middle of head. Antennae long and slender, the scape extending one third its length past the occiput, funicular joints 1–7 subequal, cylindrical, nearly three times as long as broad, joints 8–11 a little thicker than the others, apical joint as long as the two succeeding joints together. Pronotum flat, behind, sloping in front, the anterior part considerably narrowed, with margined sides; border between anterior and posterior parts angulate. Mesothorax in front flattened, disc-like; behind sloping into the broad mesoëpinotal impression; the mesothoracic spiracles are large and form distinct tubercles. Base of epinotum longer than the declivity, the surface two and a half times as long as broad, flat and narrowest in front, broadly, shallowly impressed behind, the impressed part acutely margined; posterior border margined, the two margins joining in a prominent, rounded angle; face of declivity rounded. Petiolar node thick, in profile very convex in front, nearly straight behind, the two surfaces separated by a faint margin; the anterior surface rounded, the posterior nearly flat. Gaster elongate and narrower than is usual in the genus. Legs long and slender.

Head, thorax, epinotum, and gaster subshining; seriolately punctulate, devoid of pubescence but bearing sparse, long, erect hairs. Antennae with more abundant and finer, semierect, recumbent pile. Legs finely pilose.

Gaster shining, with sparse, long, erect hairs.

Color light ferruginous, except the gaster, which is piceous.

Described from a single worker taken at Itacoatiara. It is related to *D. lutosus*, but is a more slender species, the epinotal margin is distinctly concave seen from behind, and the head is much longer, with very convex sides, and narrowed behind, and not concave at the border.

170. *Dolichoderus* (*Hypoclinea*) *championi* Forel var. *ornatus*, var. nov.

Worker. Length 6 mm.

Near *germaini*. Head elongate oval, with convex sides and feebly concave occipital border, the angles evenly rounded. Clypeus flattened at middle, anterior border straight. Mandibles as in *D. germaini*. Eyes nearly circular, located at sides of front anterior to middle of head. Antennae slender, the scape bisinuate, extending one third its length past the occipital border; funicular joints all distinctly longer than broad, the first three times, the others about twice. Pronotum flattened, a little longer than broad, the sides rounded in contour and feebly margined. Mesonotum oval, about one and one half times as long as broad, in profile gently rounded from base to the mesoëpinotal impression, which is broad and deep. Epinotum more than twice as long as broad, with the base a little longer than the declivity; in profile the base is rounded, the declivity slightly convex; the surface of the base is convex, except at the apical end, where there is a narrow shallow transverse impression, posterior to which is a slightly elevated margin; the basal surface is flat. Petiolar node thin, in profile convex in front, concave behind, the apex thinly margined; the margin not extending down the sides.

Head shining, minutely, closely punctate, thinly covered with short, suberect pile; antennae thinly pilose; mandibles punctate and pilose.

Thorax, epinotum, and petiole somewhat shining, punctate, similar to but more coarsely than the head, and more thinly pilose; the posterior surface of the node with fine transverse striolae and glabrous, except for several long hairs at the apex. Thorax shining, minutely punctate, thinly pilose.

Color black, except the legs, petiolar node, base of first gastric segment and interrupted bands at the apices of the first and second segments which are yellow. Apex of femora, tibiæ and tarsi slightly infuscated. Pile gray.

Female. Length 8 mm.

Head elongate oval, distinctly longer than broad, in general similar to that of the worker. Ocelli large and distinct, arranged in a triangle. Mesonotum flat behind, the sides with a low, rounded margin. Scutellum flat. Epinotum similar to that of the worker, but the base is much shorter in proportion to the declivity, slightly longer than broad. Petiole as in worker. Gaster longer and more slender.

Head and pronotum with foveate punctation, the punctures shallow and widely separated.

The color is the same as in the worker, except for the mandibles and a transverse stripe across the clypeus, which are rufous. The tibiae, tarsi, and tips of the femora are darker than in the worker. Wings very slightly infuscated, veins pale brown. Pilosity as in worker.

Described from large series of workers from Pará and Abuná. This is a singularly colored variety, quite different from any of the described forms. In the Pará specimens the surface of the epinotal declivity is yellow, and in those from Abuná it is black. Otherwise the two are identical.

171. *Dolichoderus* (*Hypoclinea*) *lutosus* (F. Smith).

Plate **3**, fig. 20.

Several colonies, nesting beneath stones were found at Natal and Baixa Verde. Those from the latter locality are small in size (length 3.5 mm.) and are evidently from an incipient colony. A figure of the worker is given in Plate **3**, fig. 20.

Female. Length 6 mm.

Ocelli very small, arranged in an equilateral triangle. Base of epinotum shorter than declivity.

Color similar to that of worker but more pronounced. First three gastric segments with a median longitudinal fuscous line; apex of first segment with a narrow transverse fuscous band; apical two thirds of the second and border of the third segments fuscous. Wings hyaline; veins and stigma brown.

Male. Length 3.75 mm.

Head, excluding the mandibles, as long as broad, convex behind and at sides, with large, moderately convex eyes, which occupy about half the sides. Frontal area distinct, triangular; carinae fine. Clypeus convex at middle, broadly concave at middle of anterior border. Mandibles well developed, stout, as long as the distance from their base to the eye, blade with several fine teeth anteriorly. Vertex elevated into a broad tubercle on which the large ocelli are located; in front of this, beneath the median ocellus the front has a deep, triangular impression. Antennae short, extending to base of gaster; first funicular joint a third the length of the second. Thorax robust, mesonotum evenly rounded above, with feeble Mayrian furrows. Epinotum short, base rounded, declivity flat, the two surfaces separated by an obtuse angle. Petiole twice as high as thick, anterior surface rounded, posteriorly nearly flat, the apex narrowly, thickly margined. Gaster similar to that of worker, but flattened above. Genitalia small. Hypopygium small, broadly triangular. Cerci very small. Legs slender. Wings long and narrow.

Body shining, very minutely punctate. Mandibles punctate, with several long hairs. Body without long hairs. Thorax and abdomen with sparse, regular, very minute scale-like white hairs. Funiculus densely pubescent.

Color dark fuscous, gastric segments at base lighter.

172. *Azteca schumanni* Emery subsp. *dubia*, subsp. nov.

Plate **2**, fig. 15.

Worker major. (Plate **2**, fig. 15). Length 2 mm.

Head subquadrate, one and a third times longer than broad, slightly narrowed in front, with feebly convex sides, broadly rounded occipital corners and narrowly excavated border. Clypeus convex, the anterior border broadly bisinuate. Antennal scapes extending about two thirds the distance to occipital corners; strongly arcuate and thickened toward apex; funicular joints 5–10 as broad as long. Eyes at sides of head, well in front of the middle. Pro- and mesothorax as in *A. schumanni.* Epinotum in profile rounded; the posterior portion of base flattened. Node in profile twice as high as thick, evenly rounded above. Antennal scapes and tibiae without erect pile.

Head, thorax, and abdomen with fine, long, appressed pubescence and sparse, short, erect hairs.

Color fuscous, thorax lighter, gaster darker.

Worker minor. Length 2 mm.

Head longer than broad, the width at occiput equal to that at clypeus; sides slightly convex, posterior border very feebly concave. Clypeus convex, the anterior border truncate at middle, slightly produced and rounded at corners. Eyes small, located in front of sides anterior to middle of head. Antennal scapes extending about two thirds the distance to occipital corners, funicular joints 6–10 as broad as long. Thorax and epinotum similar to that of the worker major, but the latter is somewhat flatter. Node and gaster as in the worker major.

Subshining, finely punctate. Body above with sparse, short pile and pubescence. Antennae and legs pubescent, without erect pile.

Color fuscous.

Male. Length 3.5 mm.

Head about as long as broad; sides and posterior border convex. Mandibles slender, acuminate. Anterior border of clypeus rounded. Eyes rather large and convex. Ocelli prominent, the lateral ones situated at opposite ends of a transverse elevated tubercle, which is rounded in front and behind. Antennae short and stout; first and second joints subglobose, transverse, the second the longest; third joint one and a half times longer than broad, very much thickened; joints 4–6 distinctly longer than broad, joints 7–12 proportionately shorter; apical joint one and a half times as long as penultimate.

Thorax robust, the anterior surface of the pronotum declivous in profile. Petiole and gaster similar to those of the worker minor.

Body and legs without erect pile, sparsely pubescent. Antennae, excepting the first two joints, very densely covered with rather long, erect pubescence.

Color black, legs and antennae dark fuscous. Wings hyaline. Veins and stigma fuscous.

Described from four major workers, three minors, and a male from Itacoatiara. This form differs from the typical *A. schumanni* in not having erect hairs on the antennal scape, the head is less narrowed in front, and the clypeus is not depressed at the middle. *Azteca schumanni* var. *taediosa* Forel is more robust and has the head less excavated behind and the antennal scapes longer.

173. *Azteca mülleri* Emery subsp. *terminalis*, subsp. nov.

Plate **2**, fig. 16.

Worker major. Length 4 mm.

Head, excluding mandibles, as broad as long, narrowed in front, with strongly convex sides, especially opposite the eyes, narrowly rounded occipital corners and deeply excavated border. Clypeus convex, the anterior border straight, except at corners, where it is slightly produced and rounded. Mandibles thick, with six strong teeth. Antennal scapes barely extending to occipital corners. Mesonotum in profile evenly rounded. Epinotum with subequal base and declivity, the former broadly flattened. Node rather low, rounded above. First segment of gaster depressed in middle at base.

Shining, densely punctate throughout. Pubescence abundant, long and recumbent. Pile of the scapes sparse and short, that of the body longer.

Color very dark fuscous; terminal half of antennae yellow, the color becoming more intense at apex.

Described from a series taken at Madeira-Mamoré R. R. Camp 39. The broadly flattened epinotum and the peculiar coloration of the antennae distinguish this subspecies. It is evidently close to var. *A. nigella* Emery from southern Brazil, but is larger and differently colored.

174. *Azteca aurita* Emery subsp. *silvae* Forel.

A single colony of this distinct subspecies was found at Pará, the type locality.

175. *Azteca velox* Forel var.

Colonies were found at Manaos, Abuná, Porto Velho, and Madeira-Mamoré R. R. Camps 39 and 41. There is considerable variation in the amount of infuscation on the vertex.

176. *Azteca angusticeps* Emery.

A single deälated female from Itacoatiara agrees closely with Emery's figure and description of this species.

177. *Azteca alfaroi* Emery var.

Several workers of a variety of this species were taken at Abuná. These are very close to var. *A. aequilata* Forel, but the sides of the head are more convex.

178. *Azteca trigona* Emery.

Numerous workers were taken at Manaos and on the Rio Madeira at Camps 35, 39, 41, 43, Porto Velho, and Abuná.

179. *Azteca trigona* Emery subsp. *mathildae* Forel.

This was the most abundant Azteca on the Rio Madeira. Specimens were taken at Abuná, Porto Velho, and Madeira-Mamoré R. R. Camp 43. At Itacoatiara many colonies were nesting in high, buttressed trees near the river bank.

180. *Azteca trigona* Emery subsp. *mathildae* Forel var. *spuria* Forel.

A number of colonies, in small carton nests, six or eight inches in length, were found at Ceará-Mirim. Other colonies of a variety identical with this were found at Abuná on the Rio Madeira. The latter attend Coccidae of several species, over which they build sheds. The coccids which I observed were on small bushes near the trees on which the formicaries were built. The ants energetically defended the sheds and the Coccidae.

181. *Azteca barbifex* Forel.

Very abundant at Abuná and Madeira-Mamoré Camps 28, 39 and 41. The type specimens are from the Rio Purus and the species is probably widely distributed throughout the upper Amazonian region.

182. *Azteca chartifex* Forel var.

Several workers of a variety of this species were taken at Abuná.

183. *Azteca fasciata* Emery var. *similis*, var. nov.

Minor and major workers from colonies found at Madeira-Mamoré Camps 39 and 41 differ from Emery's description and figure of *A. fasciata* from Santarem in color and in having the antennal scape noticeably longer. In the smaller worker of *A. fasciata* it extends barely past the occipital corners while in *A. similis* it exceeds these corners by a full third of its length. In *A. similis* the larger workers have the head, pronotum, anterior femora, and antennal scapes red, and the rest of the body dark fuscous. The smaller workers have the vertex, and part of the pronotum infuscated. In other characters it agrees closely with typical *A. fasciata.*

184. *Azteca lanuginosa* Emery subsp. *pruinosa*, subsp. nov.

Worker. Length 3.5 mm.

Head, excluding mandibles, as broad as long, appreciably narrowed in front, with strongly convex sides, narrowly rounded occipital corners and shallowly excavated border. Clypeus convex, the anterior border bisinuate, projecting and rounded at middle. Mandibles with a thick, blunt subapical tooth and five small teeth on the blade. Antennal scapes in the largest workers barely attaining the occipital corners, in the smaller ones slightly surpassing them. Mesonotum very convex and elevated. Mesoëpinotal suture strongly impressed. Node in profile deeper than thick, evenly rounded above.

Mandibles subopaque, densely striolate longitudinally. Head, thorax, and abdomen subopaque, finely, densely punctate.

Head and body evenly covered with fine pruinose pubescence. No erect hairs present, except a very few on the gaster.

Color dark fuscous; clypeus, antennal scapes and legs lighter.

Described from a number of workers taken at Abuná. This form is less shining than *A. lanuginosa*, the pubescence is more abundant and is closely appressed and not lanuginose in character. Otherwise the variety agrees with the typical form.

185. *Dorymyrmex pyramicus* (Roger).

Many workers were found at Natal, and Itacoatiara. In the yard of our house at Natal this and the succeeding variety were very abundant, in small crater nests.

186. *Dorymyrmex pyramicus* (Roger) subsp. *flavus* McCook.

Very common at Natal. This and the preceding have a wide distribution, ranging from Illinois in the United States to Argentina. Strangely, in spite of the adaptive nature of this ant, it has not spread out of the Americas.

187. *Tapinoma melanocephalum* (Fabricius).

Many specimens of this common tropicopolitan species were found at Pará and Porto Velho.

Camponotinae.

188. *Brachymyrmex coactus* Mayr.

One colony was found at Independencia, nesting in a twig.

189. *Brachymyrmex admotus* Mayr.

One colony was taken at Ceará-Mirim.

190. *Brachymyrmex pictus* Mayr.

Taken at Pará and Manaos.

191. *Myrmelachista (Decamera) bambusarum* Forel.

Workers taken at Itacoatiara agree with Forel's description of this species from Sao Paulo. The type specimens were nesting in bamboo.

192. *Gigantiops destructor* (Fabricius).

Found commonly at Pará, Abuná, Porto Velho, and Madeira-Mamoré Camps 39 and 41. In life this was one of the most attractive ants encountered. It lives always in the forest, where it forages either among the branches of trees or on the ground. The movements of the foraging worker are rapid, comparable to those of some of our species of Cicindela, and the bicolored antennae are kept constantly in motion.

The female is very similar to and scarcely larger than the biggest worker and the eyes and ocelli are equally well developed in both.

193. *Prenolepis* (*Nylanderia*) *longicornis* (Latreille).

Santarem, Natal, and Maranhao.

194. *Prenolepis* (*Nylanderia*) *vividula* (Nylander).

Several colonies were found at Pará.

195. *Prenolepis* (*Nylanderia*) *fulva* Mayr.

Itacoatiara.

196. *Prenolepis* (*Nylanderia*) *steinheili* Forel.

Independencia.

197. *Camponotus* (*Myrmoturba*) *maculatus* (Fabricius) subsp. *fuscocinctus* Emery.

Several workers and females were found beneath bark at Natal.

198. *Camponotus* (*Myrmoturba*) *maculatus* subsp. *fryi*, subsp. nov.

Plate 6, fig. 52.

Worker major. Length 10 mm.

Close to subsp. *C. spengleri* Forel. Head a little longer than broad, truncate behind, with broadly rounded posterior corners and slightly convex sides. Clypeus strongly carinate; the anterior border notched at middle. Cheeks in front broadly rounded. Thorax and petiolar node in profile thicker than in the other forms of *C. maculatus*, the anterior face of the latter very convex. The front and vertex are sparsely punctate, the punctures comparatively coarse. Pubescence is lacking and pile sparse.

Color brown, the head darker; the basal parts of gastric segments are transversely banded with light ferruginous.

Described from a single specimen taken at Madeira-Mamoré Camp 39. This subspecies is distinguished from the others by the thicker thorax and petiolar node and the very sparse pile.

199. *Camponotus* (*Myrmoturba*) *maculatus* subsp. *abunanus*, subsp. nov.

Plate 6, fig. 44.

Worker major. - Length 7 mm.

Head, excluding mandibles, longer than broad, narrowed in front, with convex sides; posterior border excised, straight at middle, the angles prominent, and clypeus longer than broad, very broadly carinate at middle, the anterior border bilobed. Mandibles stout, with five rounded teeth. Antennae slender, the scapes barely reaching to occipital corners of the head. Thorax slender; pronotum distinctly longer than broad. Epinotum from above four times as long as broad; in profile slightly rounding from base to declivity, the two surfaces joining in a broadly rounded angle. Petiolar node wedge-shaped in profile, the anterior surface rounded, the posterior nearly flat; seen from behind its margin is evenly rounded. Legs short; the tibiae not compressed.

Subshining; very finely shagreened, the head and pronotum less so than the rest. Mandibles sublucid, with fine punctures and few short hairs. Front with a few coarse superficial punctures. Pubescence of the head very minute, sparse, and scale-like; a few short erect hairs on the front and occiput. Thorax and abdomen with silky pubescence, which is most abundant on the gaster. Pile long and sparse on the thorax, shorter and abundant on the gaster.

Color testaceous; mandibles, antennal scapes (except tip), tarsi, and a narrow transverse band at the apex of each gastric segment dark fuscous. Pile and pubescence yellow.

Described from two major workers from Porto Velho. Possibly this should be considered a distinct species. The occipital angles of the head are unusually narrow, the clypeus more deeply notched and the antennal scapes are shorter than in the other forms of *C.* (*M.*) *maculatus*.

200. *Camponotus* (*Myrmoturba*) *melanoticus* Emery var. *substitutus* Emery.

Numerous workers were found at Natal, Independencia, and in the Maranguapé Mountains. The species nests beneath stones.

201. *Camponotus* (*Myrmothrix*) *rufipes* (Fabricius).

The typical form of this species was common, nesting in logs and beneath bark, at Ceará-Mirim, Pará, and Porto Velho.

202. *Camponotus* (*Myrmothrix*) *abdominalis* (Fabricius).

Very common at Natal, Ceará-Mirim, Baixa Verde, Pará, and Madeira-Mamoré Camps 39 and 46.

203. *Camponotus* (*Myrmothrix*) *abdominalis* var. *atriceps* F. Smith.

A single colony was taken at Abuná, Bolivia.

204. *Camponotus* (*Myrmothrix*) *rapax* (Fabricius).

Plate **5**, fig. 38.

Worker major. (Plate **5**, fig. 38). Length 12 mm.

Head one and a third times longer than broad, narrowed in front, posterior angles narrowly rounded, occipital border narrowly and rather deeply concave; the sides straight and subparallel until a little in front of middle, then convergent. Mandibles large, elongate, with six teeth on the blade. Clypeus a little broader than long, attaining side margin of head, strongly carinate, the anterior border of middle convex. Frontal area distinct, quadrangular. Frontal carinae evenly curved from base to end, which is opposite the middle of eye. Eyes small, rather flat. Antennae slender, the scapes bent at middle, extending three eighths their length beyond the occipital corners; funicular joints long and cylindrical, gradually decreasing in length apically. Pronotum broader than long, rounded at sides and above, in front finely margined. Mesonotum slightly longer than broad, narrowed behind, the base slightly less than twice the breadth of posterior portion. Epinotum at base divided by a distinct transverse suture; evenly rounded in profile; narrow above, three times as long as broad.

Petiolar node from above transverse, rounded at sides and in front; in profile narrow, two and one half times higher than thick, rounded at apex, the posterior surface nearly straight, the anterior slightly more convex. Gaster elongate egg-shaped. Legs long and slender.

Subopaque, the whole body finely shagreened, somewhat more coarsely on the head and more finely on the petiolar node. Mandibles coarsely punctate and sparsely setose. Antennal funiculus coarsely punctate.

Body with long, recumbent, silky, glistening hairs and very long erect pile. The appressed pubescence is most abundant on the gaster, thoracic pleurae, and head and absent from the petiolar node. Legs with short semidepressed hairs, femora sparsely beset with long stiff hairs. Antennal funiculus pubescent; scape with short semidepressed and sparse, longer, erect, stiff hairs.

Color black except a transverse reddish brown patch on the occiput and the dorsum of the gaster, which is light ferruginous. Pubescence yellow, pile brown.

Worker minor. Length 10 mm.

Head twice as long as broad, as broad in front as behind, with slightly convex sides and narrowly rounded occipital border. Antennal scapes extending nearly two thirds their length past the occipital borders. Thorax shaped much as in worker major. Posterior surface of petiolar node shallowly impressed at middle.

Sculpture, pilosity, and color much as in worker, but the head is entirely black.

Described from one worker major and a series of minor workers from Porto Velho and Madeira-Mamoré Camps 39 and 41. This distinct species is generally distributed throughout the Amazon region and the northern parts of South America, but it is not common locally.

205. *Camponotus* (*Myrmothrix*) *leydigi* Forel.

Workers were found on tree trunks at Independencia and Manaos.

206. *Camponotus* (*Myrmothrix*) *wheeleri*, sp. nov.

Plate 6, fig. 49–51.

Worker major. (Plate 6, fig. 50). Length 12 mm.

Head very large, nearly as broad as long, narrowed in front, with slightly convex sides, elongate, narrowly rounded occipital corners and sharply truncate posterior border. Eyes small, slightly convex. Mandibles small, short, with four coarse teeth. Clypeus about as broad as long, carinate, the anterior border broadly concave. Frontal area distinct. Frontal carinae more approximate in front than behind. Antennae short and slender, the scapes curved, extending one eighth their length past the occipital corners; funicular joints 1–3 subequal, more than three times as long as broad, joints 4–6 subequal, slightly shorter than the first three, the rest of the joints still shorter and subequal in length. Pronotum one half as broad as the head, the anterior border and the front of sides with a rounded carina. Meso- and epinotum in profile evenly arched above; from above, rounded at sides. Petiolar node in profile about as thick as long, moderately convex in front, nearly straight behind; from above as broad as long, evenly rounded in front and behind. Legs very long, the tibiae and metatarsi broad and very much depressed.

Sublucid throughout, the whole body finely shagreened, more coarsely on the head; with a covering of silky, recumbent pubescence, which is less abundant on the head, pro- and mesonotum, and the petiolar node; with long, stiff, erect hairs on the head, thorax, gaster, and legs; the head in addition bears shorter, suberect hairs.

Body and legs black, the gaster on account of the dense, silky pubescence has a yellow sheen; head reddish brown, the antennal scapes black. Pubescence and short fine pile yellow; coarse hairs black.

Worker minor (Plate 6, fig. 49, 51). Length 9 mm.

Head a little longer than broad, narrowed in front, the sides nearly straight; occipital corners broadly rounded; posterior border straight. Clypeus with straight, projecting anterior border. Antennae long, the scapes extending three fourths their length past the occipital corners of the head. Thorax and petiole similar to that of worker major. Legs as in worker major.

Sculpture, color, pile, and pubescence as in worker major, but the pubescence of the gaster is somewhat finer.

Described from a small series which was collected at Madeira-Mamoré Camp 41. The ants were nesting in a hollow palm tree and it was necessary to smoke them out. Their movements in life were very active.

The peculiar shape of the thorax, the strongly flattened long legs and the color are very distinctive.

207. *Camponotus* (*Myrmamblys*) *burtoni*, sp. nov.

Plate 6, fig. 45, 46.

Worker maior. Length 6 mm.

Head, excluding mandibles, longer than broad, broadest at occiput; posterior corners narrowly rounded, the border slightly convex; sides in front of eyes straight. Head in profile two thirds as thick as long. Clypeus a little broader than long; anterior border narrowly rounded at middle; surface very convex, with a strong carina at middle. Frontal carinae weak, extending to opposite the anterior border of eyes. Eyes small, convex, situated on sides back of posterior third of head. Antennae long and slender, scape extending half its length past the occipital corners, funicular joints long, cylindrical. Mandibles short and thick, the blade with four teeth. Pronotum twice as broad as long, the surface rather flat, sides nearly straight; anterior angles evenly rounded; sides and anterior border with a rounded margin. No mesoëpinotal suture; the mesoëpinotum rounded above, then declivous to base, in profile twice as high as thick. Node wedge-shaped, twice as deep as thick, the anterior and posterior surfaces feebly convex; narrowly rounded above.

Sublucid, head, thorax, and abdomen very densely, transversely, striolately punctate, with long silky pubescence, which is rather sparse except on the front of head and the pronotum, and abundant, stiff, erect pile, which is very long. Node without pubescence but bearing several long hairs at the apex. Antennae pubescent, devoid of pile. Femora and tibiae sparsely pilose.

Color black; mandibles and scape rufous. Pile and pubescence white.

Described from three workers taken at Madeira-Mamoré Camps 39 and 41.

208. *Camponotus* (*Myrmamblys*) *novagrenadensis* Mayr.

Two major workers were taken at Abuná.

209. *Camponotus* (*Myrmamblys*) *claviscapus* Forel.

Many major and minor workers of this species, from Natal and Ceará-Mirim, agree closely with Forel's description of the types, which were from Trinidad.

210. *Camponotus* (*Myrmobrachys*) *adpressisetosus* Forel.

Plate 6, fig. 48.

Worker major. (Plate 6, fig. 48). Length 9 mm.

Head, excluding mandibles, longer than broad, with narrowly rounded occipital corners and concave border; sides nearly straight and subparallel for half their distance from occiput to anterior border, then convex and convergent. Clypeus longer than broad, strongly keeled at middle, the sides straight and parallel; anterior border broadly concave at middle. Frontal area distinct, elongate, triangular. Frontal carinae extending to nearly opposite the posterior borders of eyes. Eyes small, very flat, located in front of sides behind the middle. Mandibles 4-dentate. Antennae short, slender, the scapes curved, extending three fourths the distance to occipital angles, funicular joints cylindrical, joints 2–10 subequal. Pronotum transverse, sides evenly rounded, surface slightly convex. Mesonotum flat above, a little broader than long, evenly rounded at sides. Mesoëpinotal suture faintly impressed. Epinotum from above three times as long as broad; evenly rounded above and at sides, without distinct base and declivity. Petiolar node twice as high as thick, rounded in front, nearly straight behind, above narrowly rounded. Gaster short and stout, oval. Legs long, tibiae moderately depressed.

Subopaque, very finely shagreened throughout, with a covering of fine silky pubescence, which is a little more abundant on the gaster and thorax than on the head. The head bears short, stiff suberect hairs, in addition to much longer erect hairs. The latter are present also on the thorax and gaster, where they form a long brush on the epinotum and the apex of node. Antennae without pubescence or pile. Mandibles subshining, finely punctate, with sparse, short hairs. Legs with sparse, fine recumbent hairs; without erect hairs.

Color black; antennae and mandibles brown, recumbent pile and pubescence golden.

Worker minor. Length 7 mm.

Head, excluding mandibles, longer than broad, narrowed in front, with slightly convex sides, broadly rounded posterior corners and straight occipital border. Clypeus as broad as long, strongly keeled at middle. Mandibles 7-dentate. Antennal scapes extending half their length past the occipital corners. Eyes large, moderately convex, located at posterior third of head. Thorax much as in major worker, but the mesoëpinotal suture less impressed. Rest as in worker major.

Many workers were taken at Ceará-Mirim, Natal, and Maranhao, from nests beneath stones.

211. *Camponotus* (*Myrmobrachys*) *crassus* Mayr.

This was the commonest of the genus on the east coast, where many workers, females, and males were taken at Natal, Ceará-Mirim, Baturité Mountains, and Maranhao.

212. *Camponotus* (*Myrmomalis*) *depressus* (Fabricius).

Plate **5**, fig. 42.

Taken at Abuná, Bolivia and Madeira-Mamoré Camp 39. This is one of the most singular ants, on account of its very elongate, flat body and the extremely long legs. The few workers which I observed were running about on leaves.

213. *Camponotus* (*Myrmepomis*) *sericeiventris* (Guérin).

Abundant on the Rio Madeira at Abuná and Camps 39 and 41.

Some years ago Mr. E. J. Newcomer gave me a live worker major of this species which was found in a restaurant at Palo Alto, California, having no doubt been imported with bananas from Central America.

214. *Camponotus* (*Myrmorhachis*) *latangulus* Emery.

Workers from Pará, Manaos, and Madeira-Mamoré Camp 39 are a trifle lighter in color than a series from Peru, but are otherwise identical.

215. *Camponotus* (*Myrmeurynota*) *heathi*, sp. nov.

Plate **5**, fig. 40, 41.

Worker major. (Plate **5**, fig. 41). Length 5.5 mm.

Head nearly as broad as long; sides straight from occipital corners to three fourths the distance to anterior border, then concave; rounded anteriorly. Occipital corners broadly rounded, the margin nearly straight. Frontal carinae narrow, not much elevated. Frontal area broad, slightly convex, anteriorly as broad as the base of clypeus, with faint longitudinal impression. Clypeus small, longer than broad, anterior border truncate, strongly carinate at middle and depressed on either side. Mandibles short and thick; bluntly dentate. Eyes small, oval, rather flat, situated much posterior to middle of sides of head. Antennae short, stout, the scape strongly inflexed, thickened at apex, barely extending to occipital corners; funicular joints thick, subequal. Pronotum as broad as long, constricted in front, the sides margined, anterior border strongly margined. Sides at middle straight, in front concave to apex, with an angle between; narrowed and rounded at base. Promesonotal impression distinct. Mesonotum triangular, rounded at sides, and slightly rounded above. Epinotum rounded at sides; at base with a large projection, which, seen from the front, has straight sides and truncate apex; from the sides this is seen to be composed of two tubercles, the one in front about half as large as the other. From the apex of this spine the epinotum in profile is concave to a point a little less than half the distance to base, where it is armed with another projection. In profile the anterior surface of this is convex, the posterior concave. This projection is twice as high as the one anteriorly and at the apical end bifurcate into two conical spines. From this to the marginate base the epinotum is concave. Petiolar node in profile thick at base and at about one third the distance from base to apex strongly constricted; apex and sides thinly marginate, the middle and the apex of sides with conical projections; anterior surface rounded, posterior deeply concave. Gaster elongate, sides slightly convex, the width of the first three segments subequal. Legs long, rather stout.

Head and thorax subopaque, minutely and densely punctate, the punctures on mesonotum and epinotum coarser. Head and pronotum with very sparse pubescence and very sparse, scattered semierect pile. Mandibles shining, with coarse punctures. Antennae finely pubescent, the apex of scape with a few erect hairs. Posterior surface of node coarsely striolately punctate, surface granular in appearance. Gaster subopaque, densely punctate, with scattered pubescence and a few erect hairs. Tibiae with sparse recumbent pubescence, but legs otherwise without hairs.

Gaster above dark brown to black, each segment with a narrow apical border of yellow; rest of body and legs ferruginous, tibiae, tarsi, and antennae somewhat darker. Pile and pubescence gray.

Worker minor. (Plate 5, fig. 40). Length 4.5 mm.

Head narrowed anteriorly; sides in front of eyes slightly convex to the anterior border, which is rounded; occipital corners very broadly rounded; occipital margin straight. Frontal carinae well elevated in front; frontal area convex. Clypeus rounded in front, longitudinally carinate at middle. Mandibles thick, the blade with five teeth. Eyes oval, convex, located at middle of sides of head. Scape of antennae extending nearly half its length beyond occipital corners, slightly bent, and thickened at apex; joints of funiculus subequal in length, each about twice as long as broad. Pronotum convex, one and one half times as broad as long, broadest in front; anterior border convex, posterior concave; sides in front broadly margined, the anterior corners laminate. Mesonotum obliquely flattened at sides, carinate at middle; the carinae, at junction of meso- and epinotum extended into a long projection which is bent backward and flattened at apex. At the base of the pronotum, on the sides is a small, but distinct tubercle. Epinotum carinate at middle; the sides very oblique. Slightly posterior to middle of epinotum is a second projection, longer than the first, and thicker at base; seen in profile this is bent backward; it is tuberculate on the front surface at a little less than half the distance to apex. The apex is deeply bifurcate for nearly one half the length of spine. From the base of this projection the epinotum is concave to base. Node of petiole, seen in profile, longer than high; seen from behind about as thick as high. The apex slightly margined, with three long, acuminate spines, one at apex, and others at middle of sides. Posterior surface of node flattened. Gaster elongate, sides slightly convex. Legs long, rather stout.

Head, thorax, and epinotum subopaque, finely punctate. The punctures are very dense on the head and pronotum, giving these portions a velvety appearance. Head and pronotum with regular, recumbent pubescence, the head with a very few short, erect hairs. Antennae sparsely pubescent. Surface of posterior declivity of petiolar node granular. Gaster densely, minutely punctate, with thin pubescence and sparse, short erect pile. Legs sparsely hairy.

Head above fuscous; each occipital corner with a ferruginous blotch that extends in front of and beneath eye. Front of head, from a short distance beneath insertion of antennae yellow. Mandibles light ferruginous. Antennae fuscous, the scape at basal half ferruginous. The apical border of first gastric segment, the remaining segments of gaster and the apices of tibiae fuscous, rest of body and legs ferruginous. Pile and pubescence white.

Porto Velho, Abuná, and Camp 39 on the Madeira-Mamoré R. R. The specimens were found running about on leaves.

The subgenus Myrmeuryota includes the species which have the meso- and epinotum armed with spines. Of the nine known species, all excepting *C.* (*M.*) *heathi* and *C.* (*M.*) *eurynotus* Forel are West Indian. The latter species, described from a worker minor from Tonantins in Brazil has the pronotum much broader than in *C.* (*M.*) *heathi*, the epinotum is different and the petiolar node is not spinose. Like *C.* (*M.*) *cristophei* and *C.* (*M.*) *toussainti*, which I found on leaves and tree trunks in Hayti, *C.* (*M.*) *heathi* is probably an arboreal species.

I have much pleasure in dedicating this extraordinary species to my former professor, Dr. Harold Heath, a member of the Stanford Expedition and my companion on many collecting trips.

216. *Dendromyrmex traili* May. *rufogaster*, var. nov.

Several specimens in the Wheeler collection from Bolivia (Staudinger) differ from Mayr's description in having the gaster chestnut red, instead of black. In other characters these agree well with the description, and should, I think be considered a distinct variety of *D. traili*.

217. *Dendromyrmex nidulans* Smith.

One specimen, referable to this species, taken at Camp 39, Madeira-Mamoré R. R. *Dendromyrmex nidulans* most closely approaches *D. fabricii* Roger but has not a dense mat of pubescence on the gaster.

218. *Dendromyrmex fabricii* Roger.

One worker from Pará.

219. *Dendromyrmex chartifex* Smith var. *felis*, var. nov.

The worker of this variety differs from the typical form in being subopaque instead of shining. The whole body is more hairy. The dense pubescence on the gaster gives it a velvety appearance. The color is yellowish brown.

Female (deälated). Length 10.5 mm.

Head small, sides in front of eyes almost straight, curving slightly towards base of clypeus; sides behind eyes convex to posterior margin, which is slightly concave. Clypeus broad, carinate, the anterior border truncate. Mandibles with six teeth. Eyes small, situated posterior to middle of sides of head. Ocelli small. Frontal lamellae elevated; enclosed area very slightly impressed at middle. Antennae about two thirds as long as body. Pronotum narrow, anterior border with raised margin which extends part way along the sides. Mesonotum much elevated, declivous in front, flattened above, with faint indications of margin at sides. Epinotum rounded above and at sides, margined at base. Node as in worker. Gaster ovate. Legs long and slender.

Head, thorax, epinotum, and node subopaque, densely, finely punctate, minutely striolate transversely, with very sparse pubescence, but with abundant, semierect pile.

Gaster subopaque, densely punctate and striolate, both punctures and striae being extremely minute. The pubescence is very sparse and fine; the pile erect, not abundant.

Scape of antennae and legs with many erect hairs; funiculi pubescent.

Color as in worker.

Described from several workers and a female taken at Tumatumari, British Guiana (Amer. Mus. Nat. Hist. collection).

220. *Dendromyrmex chartifex* subsp. *mamoreënsis*, subsp. nov.

Worker. Body much more robust than in the typical form of the species. Head constricted behind the eyes, sides convex, occipital border with edge rounded, without trace of margination. Sides of head in front of eyes evenly convex, narrowed toward base of clypeus. Clypeus strongly carinate. Mandibles with six teeth on the blade. Surface of frontal area convex, longitudinally carinate at middle. Antennae nearly as long as body, rather thick. Pronotum nearly as broad as long, depressed, and broadly margined anteriorly; seen in profile, the surface is convex; sides distinctly margined for three fourths the distance to promesonotal suture. Mesonotum slightly convex above, rounded at sides. Epinotum flattened, sides marginate. Petiolar node, seen in profile on anterior side straight and perpendicular at base, then sloping to apex, with an acute angle between the two surfaces; posterior surface convex; from behind, evenly rounded above. Gaster ovate, short and thick. Legs long and slender.

Body nearly opaque, gaster subshining; antennae and legs sublucid.

Head, thorax, and abdomen finely, densely punctate and striolate, with abundant closely appressed pubescence, which gives the insect a velvety appearance. Body everywhere, except on funiculus, with numerous erect or suberect hairs.

Color dark ferruginous, legs lighter. Pile and pubescence gray.

Camp 39 Madeira-Mamoré R. R.

This subspecies differs from typical *D. chartifex* in its more robust form, proportionately larger head and the opaque or semiopaque structure of the integument. In a series of *D. chartifex* from Bon Lugar on the Rio Purus (Coll. Goeldi, det. Forel) before me, the whole body is much more shining than in *D. mamorcënsis*, and the pubescence much more sparse. The head is proportionally smaller, and the occipital margin is distinctly, though narrowly, margined.

221. *Dendromyrmex madeirensis*, sp. nov.

Worker. Close to *D. apicalis.*

Head with sides in front of eyes evenly convex, considerably narrower at base of clypeus than in front of eyes; sides of occiput convex; occipital border narrowly, but distinctly margined; the sides, seen from above, angulate. Eye situated distinctly behind middle of head. Frontal area broad, convex, faintly longitudinally impressed at middle. Clypeus strongly carinate; the anterior border slightly concave; mandibles with six teeth. Antennae long and slender. Pronotum longer than broad, sides submarginate; strongly impressed and margined at anterior border. Surface, except for anterior depression, slightly convex. Mesonotum rounded above and at sides. Epinotum seen in profile, convex from apex to base; sides weakly margined, surface flat. Apex of node, seen in profile acutely angulate, from behind truncate, the sides near apical margin nearly straight, forming an angle with the apical margin. Gaster ovate. Legs long and slender.

Head shining, finely striolate and punctate, with rather sparse pubescence and abundant semierect pile. Scape of antennae shining, coarsely punctate, without pubescence, but with much long erect pile; funiculus thickly pubescent, with short pile. Pronotum shining, sparsely punctate, with sparse, long, recumbent and a few erect hairs. Mesonotum more densely punctate and more thickly pubescent than the pronotum. Epinotum and petiole semilucid, finely striate transversely, the former with very sparse pubescence and a few long, erect hairs, the latter without pubescence, but with a few erect hairs. The first segment of gaster shining, minutely striolate, with very sparse appressed hairs and a few long ones. Rest of gaster more pubescent, and pilose, striolate, semishining. Legs shining, femora and tibiae pilose, tarsi with semiappressed pubescence.

Color black, except legs, which are dark reddish brown. Pile and pubescence gray.

Described from one worker taken at Abuná, Rio Madeira.

222. *Dendromyrmex apicalis*, sp. nov.

Plate 6, fig. 43.

Worker. Length 8.5 mm.

Head one and one fourth times as broad as thorax, with sides in front of eyes very slightly convex; behind eyes narrowed to near the base, then reflexed outward, forming a short, but distinct neck. Frontal laminae short and protruding. Clypeus longitudinally carinate. Mandibles thick, the blades with six acute teeth. Antennae long and slender, the scape extending a little past the promesothoracic suture. Eyes hemispherical. Frontal area but little longer than broad; with a strong longitudinal impression. Eyes small, hemispherical, located only slightly behind and beneath middle of sides of head. Pronotum noticeably longer than broad; sides round, in front semimarginate; surface slightly convex posteriorly, flattened anteriorly, but not disciform. Mesothorax as broad as long, sides evenly rounded, seen in profile slightly convex, with faint depression at middle. Epinotum a little over three times as long as broad, sides slightly convex, evenly margined; in profile evenly convex from apex to base, surface flattened. The perpendicular anterior surface, and the slanting anterior surface of the petiolar node form an acute angle at the apex. Postpetiole with slight depression at middle; apex, seen from behind rounded. Gaster suboval. Legs long and slender.

Body, except gaster and legs, sublucid throughout, gaster shining. Head and thorax finely, transversely striolate, the striae more coarse on the epinotum and petiolar node, but extremely delicate on the gaster. Body finely punctate, each puncture with a short, recumbent hair.

Scape of antennae with a thin pubescence; funiculus with thicker pubescence. The head, coxae, and gaster with a few long hairs, other parts of body without them.

Color black, apical four joints of antennae brown, tarsi brown.

Described from one worker taken at Madeira-Mamoré R. R. Camp 39.

The elongate pronotum which is only faintly depressed anteriorly, the shining black color throughout, the brown tarsi and tips of the antennae and the nearly entire absence of pilosity, distinguish *D. apicalis* from the other species of the genus. It approaches most closely *D. madeirensis* from the same region, but differs from this in the shape of the head, the rounded sides of pronotum, the structure of the petiolar node, and in the extremely sparse pubescence and pilosity.

223. *Dendromyrmex branneri*, sp. nov.

Plate 6, fig. 47.

Worker. Length 8 mm.

Head about one and one half times as long as broad, sides in front of eyes slightly convex, slightly broader at base of clypeus than in front of eyes, anterior corners angulate; occiput strongly contracted, seen from above with almost straight margin to a point a little over half the distance from eye to apex, then contracted into a narrow neck which is longer than broad, and has the posterior edge strongly reflexed. Clypeus slightly broader than long; sides straight, with a strong carina for entire length; anterior border truncate. Frontal area suboval in shape, with a longitudinal carina. Frontal laminae moderately elevated, approximating anteriorly. Mandibles rather slender, blade with five teeth. Antennae long and slender, scape extending a little beyond the mesoëpinotal impression, joints of flagellum subequal in length, all longer than broad, the anterior ones somewhat the thickest. Eye small, very convex, situated at posterior fourth of head. Thorax long and slender, the width contained four times in the length. Prothorax broadest at anterior third, constricted in front, sides evenly rounded; in profile very slightly convex. Promesonotal impression not deep. Mesonotum evenly rounded to near apex, where there is a strong transverse constriction; the sides from above strongly concave. Epinotum slightly over twice as long as broad, divided at anterior third by a broad transverse impression, which gives the profile the shape of a saddle; the declivity short, with flattened surface, reflexed at base. Petiolar node thick; rounded above and at sides, a little broader than long; in profile rounded in front, nearly straight behind; the posteroventral surface of the petiole with a rounded projection. Ventral surface of mesothorax with an angulate tooth at anterior third. Gaster elongate oval, about two thirds as long as the thorax. Legs very long and slender.

Head sublucid, finely, densely, and evenly punctate. Thorax shining, minutely punctate. Epinotum finely striate, sublucid. Node sublucid, more coarsely striate transversely. Gaster shining, finely striolate.

Head without pubescence but with sparse, erect pile, antennae more coarsely pilose, funiculus pubescent, and with erect pile. Thorax, petiole, and node without pubescence, and but sparsely pilose. Gaster with scattered pubescence and sparse erect pile. Legs pilose, tibiae with a little pubescence.

Color dark ferruginous, the thorax lighter in color than the head or abdomen. Pile and pubescence white.

Described from several workers taken at Abuná. This is a very aberrant form, resembling at first sight one of the elongate American species of Dolichoderus. The long neck and the divided epinotum widely separate this species from those others which have been included in the genus Dendromyrmex.

Camponotus (*Dinomyrmex*) *agra* Smith has the occiput drawn out into a neck, and the head of the worker minor resembles that of *Dendromyrmex branneri*, but the thoracic structure is entirely different.

The following key will serve for the identification of the species of Dendromyrmex.

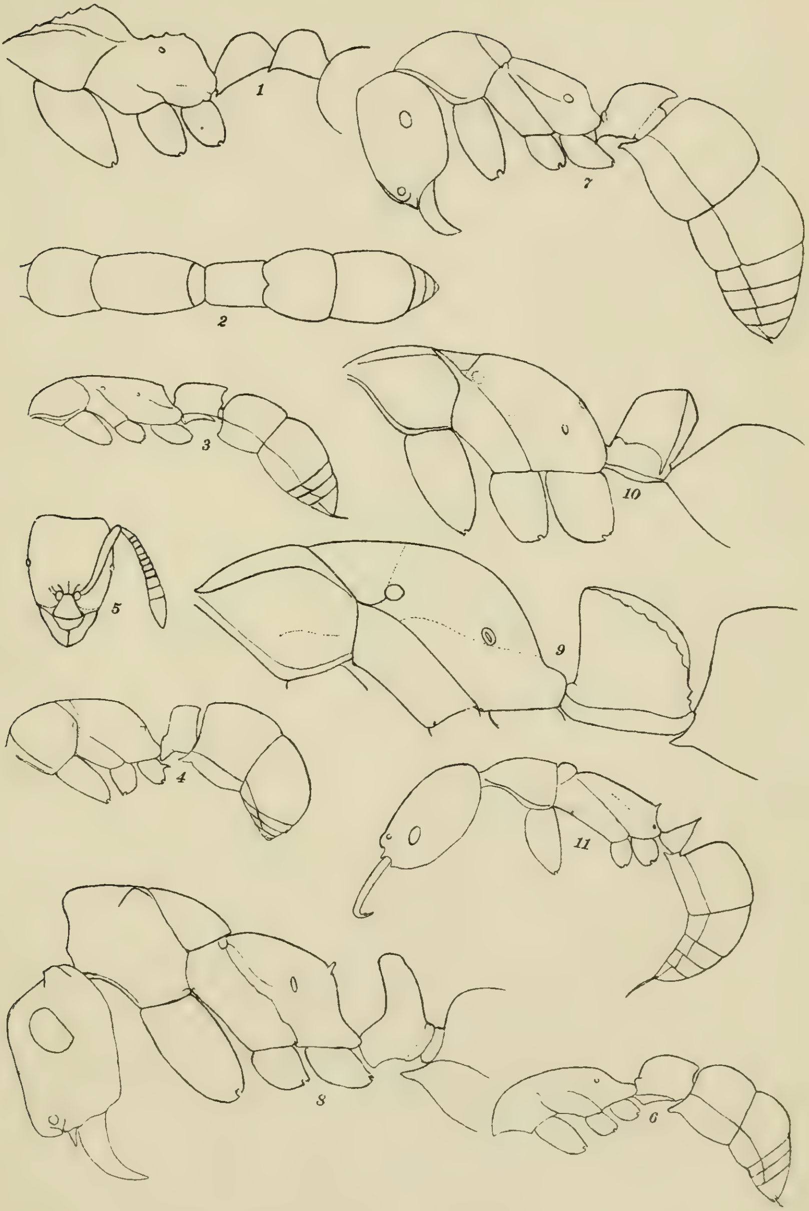
Form very long and slender; occiput drawn out into a narrow neck which is longer than broad; epinotum divided by broad transverse depressions into two portions (saddle-shaped in profile). *branneri* Mann
Form more robust; occiput not long; epinotum not divided....1
1. Thorax brown, or yellowish brown........................2
Thorax black, or at least dark brown........................4
2. Gaster shining..............................*chartifex* Smith
Gaster opaque...3
3. Head smaller; occiput faintly margined; color yellow. (British Guiana)..........................*chartifex* var. *felis* Mann
Head larger; occiput not margined; color reddish. (Brazil) *chartifex* var. *mamorcënsis* Mann

4. More slender species; body black; thorax shining.............5
More robust species partly brown; thorax subopaque.........6
5. With very sparse pile; tips of antennae brown; neck shorter; anterior border of clypeus convex..............*apicalis* Mann
Abundantly pilose; tips of antennae black; neck longer.
madeirensis Mann
6. Gaster shining......................................7
Gaster opaque.......................................8
7. Gaster black................................*traili* Mayr
Gaster red........................*traili* var. *rufogaster* Mann
8. Gaster brown, with distinct punctation......*nidulans* (Smith)
Gaster black; punctation very fine............*fabricii* Roger

PLATE 1.

PLATE 1.

Fig. 1. Eciton (Acamatus) legionis F. Smith subsp. crenulatum Mann. Worker.
2. Platythyrea meinerti Forel. Worker. Dorsal view.
3. Platythyrea meinerti Forel. Lateral view.
4. Rhopalopone relicta Mann. Worker.
5. Head of same from front.
6. Ectatomma (Gnamptogenys) tortuolosum F. Smith. Worker.
7. Ectatomma (Gnamptogenys) concinnum (F. Smith). Worker.
8. Ectatomma (Ectatomma) confine Mayr. Worker.
9. Neoponera (Neoponera) bakeri Mann. Worker.
10. Neoponera (Neoponera) carinulata (Roger). Worker.
11. Anochetus (Anochetus) bispinosus (F. Smith). Worker.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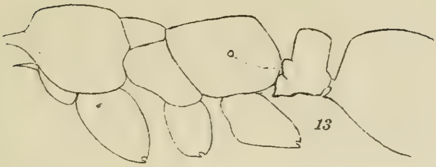
HELIOTYPE CO., BOSTON.

PLATE 2.

PLATE 2.

Fig. 12. Belonopelta jeckylli Mann. Worker. Dorsal view.
13. Belonopelta jeckylli Mann. Worker. Lateral view.
14. Neoponera (Neoponera) cavinodis Mann. Worker.
15. Azteca schumanni Emery subsp. dubia Mann. ☿.
16. Azteca mülleri Emery subsp. terminalis Mann. ☿.
17. Dolichoderus (Monacis) tristis Mann. ☿.
18. Dolichoderus (Dolichoderus) imbecillus Mann. ☿.



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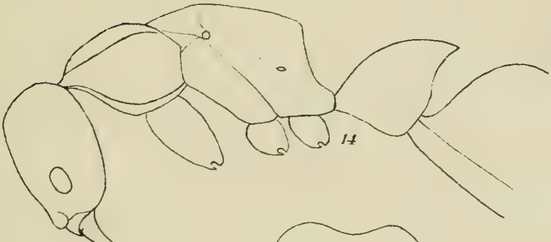

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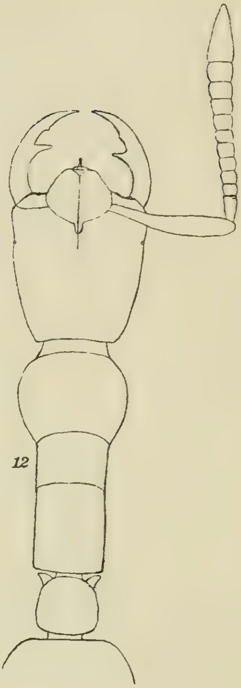

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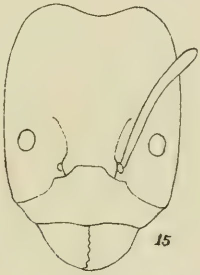

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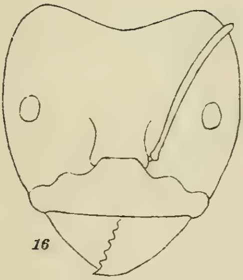

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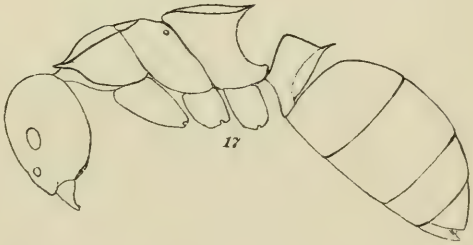

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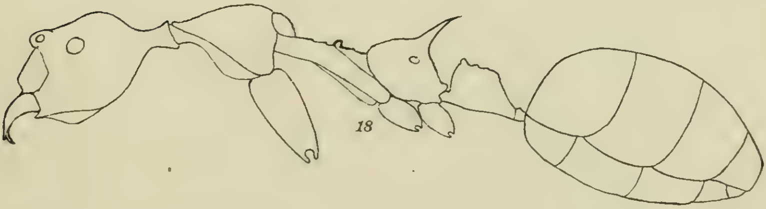

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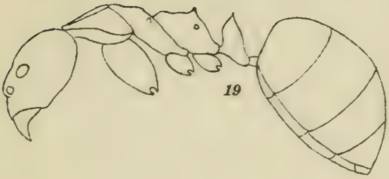
HELIOTYPE CO. BOSTON.

PLATE 3.

PLATE 3.

Fig. 19. Dolichoderus (Hypoclinea) ghiliani Emery. ☿.
20. Dolichoderus (Hypoclinea) lutosus F. Smith. ☿.
21. Pseudomyrma arboris-sanctae Emery. ☿.
22. Pheidole (Pheidole) carapuna Mann. Soldier.
23. Pheidole (Pheidole) wheeleri Mann. Soldier.
24. Pheidole (Pheidole) biconstricta Mayr subsp. burtoni Mann. Soldier.
25. Pheidole (Pheidole) colobopsis Mann. ♀.
26. Head of same from front.
27. Crematogaster (Crematogaster) heathi Mann. ☿.
28. Megalomyrmex wallacei Mann. ☿.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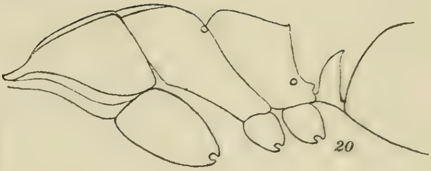
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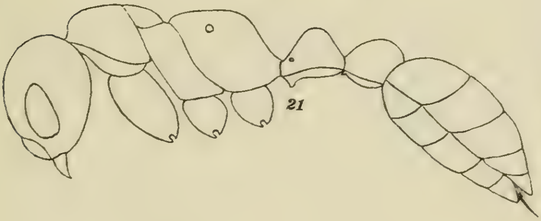
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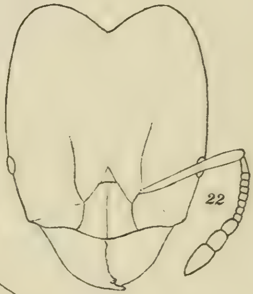
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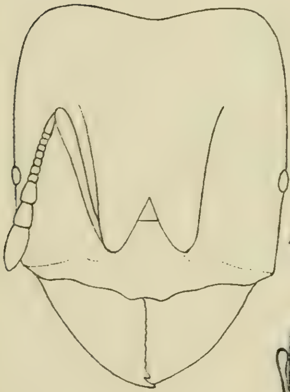
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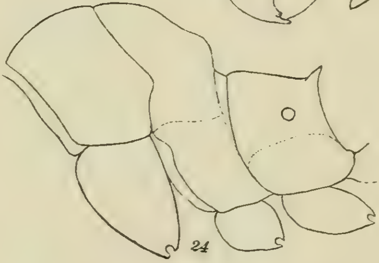
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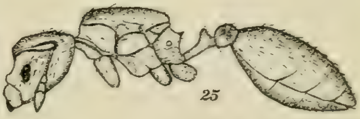
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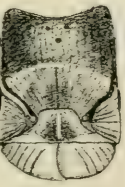
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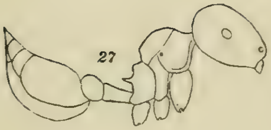
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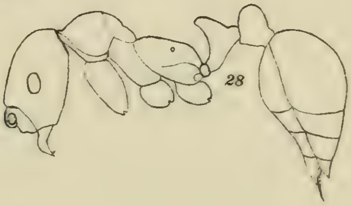
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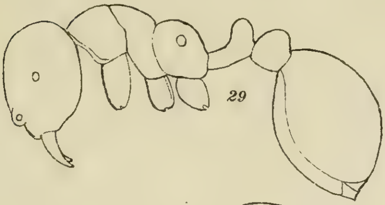
HELIOTYPE CO., BOSTON.

PLATE 4.

PLATE 4.

Fig. 29. Monomorium (Mitara) subterraneum Mann. ☿.
30. Head of same from front.
31. Solenopsis geminata (Fabr.) subsp. medusa Mann. Soldier.
32. Myrmicocrypta foreli Mann. ☿, head from front.
33. Myrmicocrypta foreli Mann. ♀.
34. Myrmicocrypta foreli Mann. ☿.
35. Cryptocerus (Cryptocerus) complanatus Guérin. Soldier.
36. Leptothorax (Goniothorax) echinatinodis Forel subsp. spininodis Mayr. ☿.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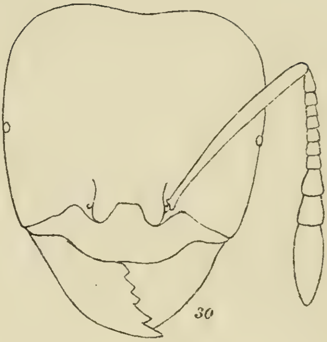
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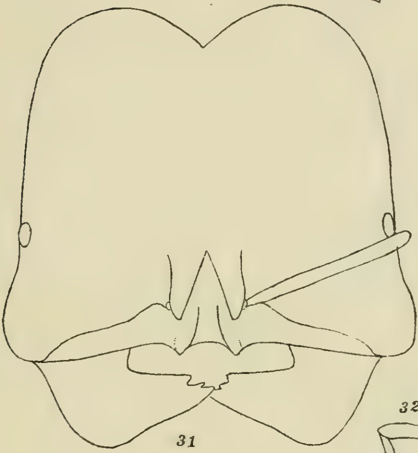
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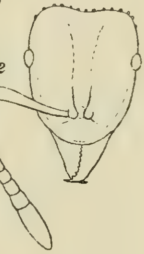
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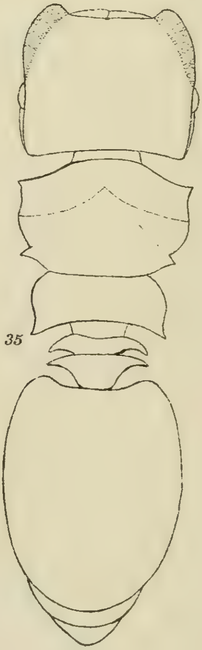
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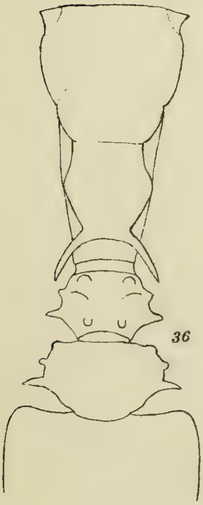
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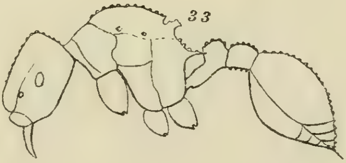
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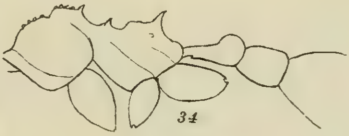
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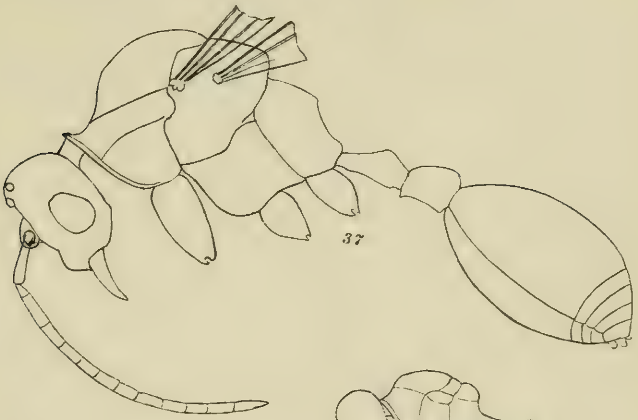
HELIOTYPE CO. BOSTON

PLATE 5.

PLATE 5.

Fig. 37. Apterostigma branneri Mann. ♂.
38. Acanthognathus ocellatus Mayr. ♀.
39. Camponotus (Myrmothrix) rapax (Fabr.). ☿ major.
40. Camponotus (Myrmeurynota) heathi Mann. ☿ minor.
41. Camponotus (Myrmeurynota) heathi Mann. ☿ major.
42. Camponotus (Myrmomalis) depressus Mayr. ☿.



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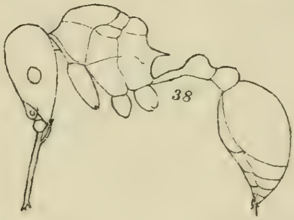

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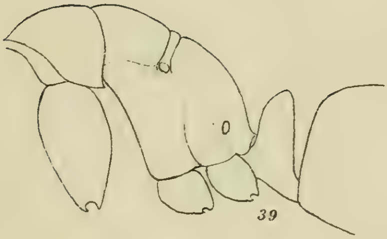

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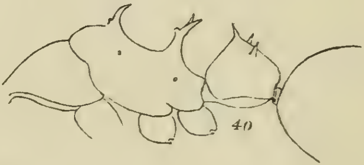

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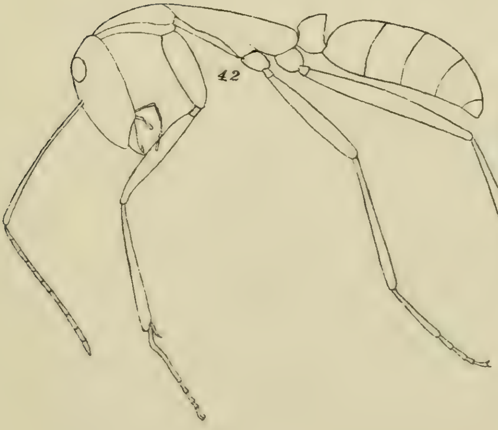

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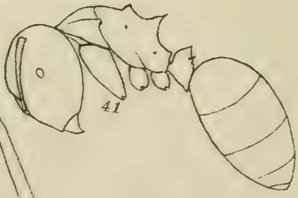

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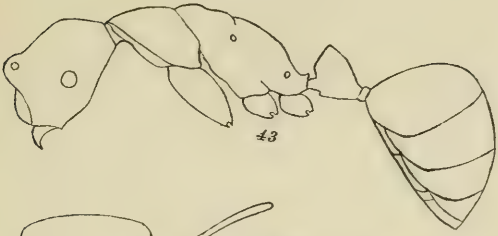
HELIOTYPE CO., BOSTON

PLATE 6.

PLATE 6.

Fig. 43. Dendromyrmex apicalis Mann. Worker.
44. Camponotus (Myrmoturba) maculatus Fabr. var. abunanus Mann. Worker.
45. Camponotus (Myrmamblys) burtoni Mann. Worker major.
46. Camponotus (Myrmamblys) burtoni Mann. Head from front.
47. Dendromyrmex branneri Mann. Worker.
48. Camponotus (Myrmobrachys) adpressisetosus Forel. Worker major.
49. Camponotus (Myrmothrix) wheeleri Mann. Worker minor.
50. Camponotus (Myrmothrix) wheeleri Mann. Worker major.
51. Camponotus (Myrmothrix) wheeleri Mann. Worker minor.
52. Camponotus (Myrmoturba) maculatus Fabr. subsp. fryi Mann. Worker major.

Note. In the figures of *Camponotus* (*Myrmothrix*) *wheeleri* the points of insertion of the antennae are shown too far from the clypeus.



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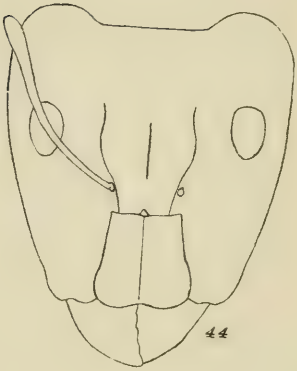

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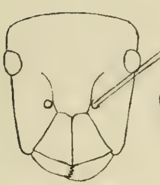

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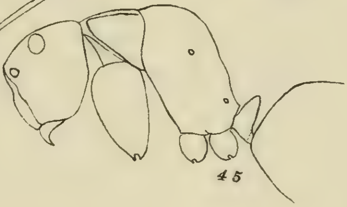

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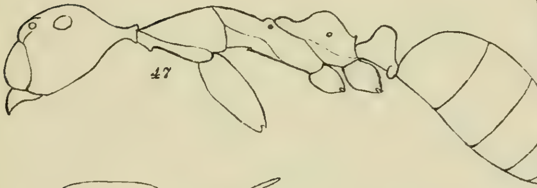

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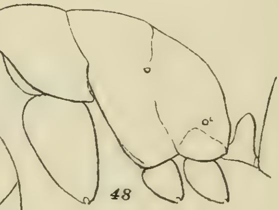

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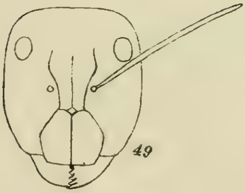

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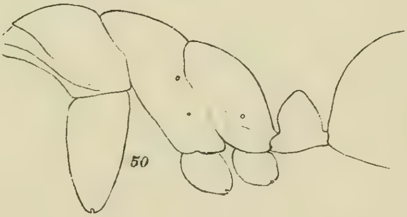

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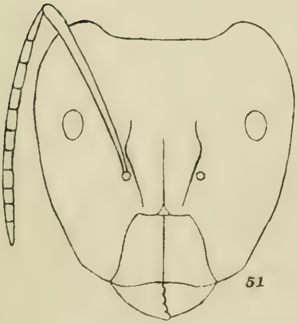

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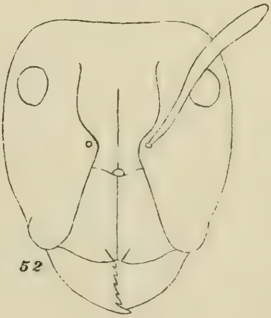

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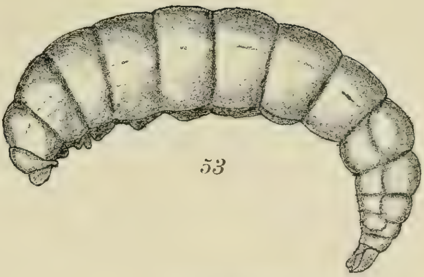
PLATE 7.

PLATE 7.

Fig. 53. Platythyrea meinerti Forel. Full-grown larva.
54. Ectatomma (Ectatomma) quadridens (Fabr.). Larva.
55. Dinoponera grandis Guérin subsp. mutica Emery. Immature (?) larva.
56. Pseudomyrma rufa F. Smith. Female (deälated).



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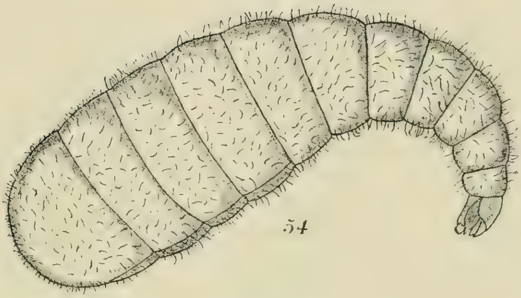

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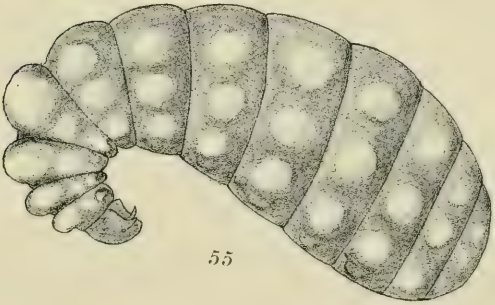

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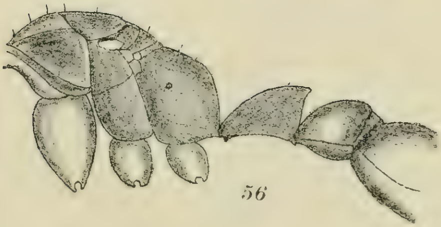

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HELIOTYPE CO. BOSTON

Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. LX. No. 12.

THE FOSSIL ELATERIDAE OF FLORISSANT.

By H. F. Wickham.

With Seven Plates.

CAMBRIDGE, MASS., U. S. A.:
PRINTED FOR THE MUSEUM.
October, 1916.

No. 12.— *The Fossil Elateridae of Florissant.*

By H. F. Wickham.

Elaterid beetles are fairly common as fossils. Some of the earliest Coleoptera known, occurring in the Triassic rocks, had the form of an Elater more or less sketched out but, according to Handlirsch, who has seen the specimens, none of them displayed characters which would allow them to be placed in the modern family with any certainty. Again, in the Liassic beds, the elateriform Coleoptera appeared, this time in rather greater abundance, but even yet they seem to present no evidence of belonging to the family in a proper sense. The lithographic chalk of Jurassic times has furnished insects which have even been referred to the recent genus Elater but here, as before, Handlirsch believes that the closeness of relationship has been overestimated, though he states that his Jurassic genus Malmelater belongs at any rate to the Elateridae. This seems to be the earliest well-supported record of the appearance of the family in geologic time.

Following the Jurassic, we have a period of immense duration in which no large deposits of Coleoptera were made or, if they exist, none have been discovered. No more Elateridae are recorded until after the opening of the Tertiary, when they begin to be at least moderately numerous. Menge is said to have had 130 specimens from the Amber fauna. In the later deposits of Oeningen and other European Miocene localities they seem to be quite abundant, Heer having described many, some in fine preservation. By this time they had become so much like our modern forms that generic identity frequently seems quite well established though one cannot feel sure that some important character may not have been carried away with a missing member. Tarsal lobes and claw-teeth scarcely ever remain intact, the mesosternum is often too distorted to study and in many instances it is impossible to make out the limits of the metacoxal plates which play so large a part in the classifications of systematists.

In the way of giving at a glance the published standing of Elateridae in Tertiary strata, the following outline, compiled mostly from Handlirsch and with his assignment of the age of each deposit, may be useful. The records are given by localities in preference to arrangement by generic sequence.

Paludina Beds, England. *Lower Eocene.*
Elater sp.

Baltic Amber. *Lower Oligocene.*
Eucnemidae, (many).
Eucnemis sp.
Microrhagus sp.
Elateridae, (many).
Cardiophorus, (two ? sp.).
Cryptohypnus, (two sp.).
Elater, including Ampedus, (seven sp.).
Elater naumanni Giebel.
Agriotes sp.
Limonius, (two sp.).
Athous sp.

Aix. *Lower Oligocene.*
Elater, (two sp.).

Siebengebirge. *Upper Oligocene.*
Silicernius spectabilis Heyd.

Greith, Switzerland. *Upper Oligocene.*
Elaterites amissus Heer.

Spitzbergen. *Lower Miocene.*
Elater holmgreni Heer.
Elater ehrenwardi Heer.

Kutschlin, Bohemia. *Lower Miocene.*
Campsosternus atavus Deichm.
Elaterites dicrepidioides Deichm.

Oeningen. *Upper Miocene.*
Adelocera granulata Heer.
Lacon primordialis Heer.
Alaus spectabilis Heer.
Cardiophorus brauni Heer.
Cardiophorus sp. nov.
Elater, (five sp.).
Ampedus seyfriedi Heer.
Ischnodes gracilis Heer.
Limonius optabilis Heer.
Corymbites sutor Heer.
Elaterites lavateri Heer.
Elaterites obsoletus Heer.
Elaterites, (five sp.).

Myszyn, Galicia. *Upper Miocene.*
Elater wisniowskii Lomn.

From the above list, it will be seen that only eighteen species have been specifically characterized from the European Tertiaries, scarcely enough to make a comparison with the Florissant fauna of any value. It should be noted, however, that several of the principal genera are taken to be identical in the two areas. Too much confidence must not be given the determinations in any case. Outside of the Florissant district, the only North American Tertiary Elateridae thus far made known are these:—

Green River, Wyo. *Oligocene.*
Corymbites velatus Scudd.

White River, Colorado-Utah. *Oligocene.*
Epiphanis deletus Scudd.

Fossil, Wyo. *Oligocene.*
Adocetus buprestoides Scudd.

Similkameen River, B. C. *Miocene.*
Limonius impunctus Scudd. Elaterites sp.

Nicola River, B. C. *Miocene.*
Cryptohypnus (?) terrestris Scudd.

These five records (since that of Elaterites cannot be considered as having any special value) are even less illuminating than those of Europe. Three of the genera are now recognized from Florissant.

Years ago, Scudder announced that he had about forty species of Florissant Elateridae but he never gave them detailed study and it is probable that the number was somewhat overestimated. At any rate, when I looked through his collections in 1912 I was unable to distinguish so many and of those in his cabinet a good proportion was too poor for identification. Later explorations have brought in about as many specimens as were known to Scudder and by a study of the material belonging to the Museum of Comparative Zoölogy, the United States National Museum, the Princeton University Geological Museum, the Museum of the University of Colorado and the Peabody Museum of Yale University, supplemented by a collection of my own, I have separated forty-three species with some degree of certainty as to their generic and specific affiliations. For convenience in making comparisons, this list is appended. Excepting four which I have described in earlier papers, all are new and are characterized in the body of this article.

Eucneminae.

Eucnemis antiquatus.
Deltometopus fossilis.
Fornax relictus.
Microrhagus miocenicus.
Microrhagus vulcanicus.

Elaterinae.

Lacon exhumatus.
Cardiophorus lithographus.
Cardiophorus florissantensis.
Cardiophorus cockerelli.
Cardiophorus requiescens.
Cardiophorus (?) deprivatus.
Horistonotus coloradensis.
Cryptohypnus exterminatus.
Cryptohypnus hesperus.
Anchastus eruptus.
Anchastus diluvialis.
Monocrepidius dubiosus.
Elater rohweri.
Elater scudderi.
Elater florissantensis.
Megapenthes primaevus.
Cryptagriotes minusculus.
Agriotes comminutus.
Agriotes nearcticus.
Limonius aboriginalis.
Limonius florissantensis.
Limonius praecursor.
Limonius shoshonis.
Limonius volans.
Athous lethalis.
Athous contusus.
Athous fractus.
Paranomus exanimatus.
Paranomus heeri.
Paranomus laevissimus.
Ludiophanes haydeni.
Corymbites granulicollis.
Corymbites primitivus.
Corymbites submersus.
Corymbites restructus.
Corymbites propheticus.
Oxygonus primus.
Melanactes cockerelli.

Assuming the above species to be correctly referred to their respective genera, analysis shows that five belong to the Eucneminae, the remaining thirty-eight to the Elaterinae. Of those in the second category, one belongs to the Agrypnini, the other thirty-seven to the Elaterini which holds today the great bulk of North American species of the subfamily. According to the classification adopted by LeConte, the Elaterini separates on the basis of the structure of the metacoxal plates into two subtribes, the Elaterini (genuini) and the Corymbitini, dividing the North American species between them almost exactly in the ratio of three to four. Of the fossils, fifteen are referred to the first subtribe, twenty-two to the second, giving a ratio rather startlingly similar. Of course the number of species involved is small enough to allow a considerable percentage of error to creep in, should the identifications turn out to be wrong in any case, but the conclusions must be held to have some weight. On the face of the matter, the figures would indicate that the relative percentages of Elaterini and Corymbitini were almost the same at Florissant during the Miocene as they are in North America in general today.

Making some comparisons with the recent Elateridae of Colorado, we find recorded in the catalogue of the beetles of that state about seventy-three species, three of which are Eucneminae, leaving seventy in the Elaterinae. Of these, three are Agrypnini, three Chalcolepidiini (a tribe not represented among our fossils and containing large species rather tropical than otherwise in their general range, though the Colorado representatives are of the genus Alaus which runs well to the north) while the rest, sixty-four in number, are Elaterini. These Elaterini are divided into twenty-nine which belong to the subtribe Elaterini proper and thirty-five to the Corymbitini, a moderate divergence from the ratio shown at Florissant in the Miocene. If we may depend upon these figures, the evidence indicates a rather remarkable similarity in conditions then and now.

Two or three items of generic comparison deserve notice. In looking over the fossils I was surprised to find such an apparent richness in Cardiophorus; but turning to the Colorado catalogue it will be noted that Cardiophorus now has no less than eight representatives in the state, against the five known as fossils. Here again, the two ratios are remarkable for their similarity. Of the genus Corymbites, we find sixteen recent Colorado species against five fossils — indicating that this genus, relatively to the other Corymbitini, was only half as numerously represented then as at present. Of the twenty-one genera included in the entire list of fossils, nine are not now known from Colorado; two of these are erected as new, four others are fairly distinctively northern and none of the three remaining can be considered southern types. In fact, there is nothing in the fossil Elateridae to indicate tropical or subtropical conditions or origin.

Something should be said regarding the facies of this collection of Elateridae. On looking through the list, one will be struck at once by the fact that it is made up, in the main, of species belonging to large and well-known genera, mostly those of wide distribution. Even if we allow that the preservation of fossil beetles is practically never good enough to permit absolute certainty in generic identification, it remains true that these Florissant Elateridae do not, even in a single instance, exhibit anything conspicuous or remarkable in size or form. This family, today, is by no means without peculiar and highly modified members, some of them reaching great size, others displaying oddities in outline or in the development of various portions of the body, as will be seen in glancing over the plates in the extensive monograph of Candèze. We are forced here, to the same conclusion as in so many of the other families — that the Florissant fauna, outside of the rhynchophorous series, comprised a rather monotonous and little specialized lot of beetles.

This paper, with another now in press elsewhere, will bring the number of published Coleoptera from these shales up to about 566 species, and may be considered as very nearly ending the task of working up the available material. What remains consists of isolated species in various families so scattered through the whole order as not essentially to disturb the conclusions already reached in regard to the number and nature of the representation of each group. The richness of this fauna remains absolutely unapproached by that of any other known deposit, unless the many unworked collections of Amber insects may yield a similar wealth.

Citation of catalogue numbers follows the plan of Scudder, in joining by "and" those referring to the two halves of a single specimen with its counterpart. The drawings are made with the camera lucida and will show the outlines, though not the sculpture, the latter being carefully described in the specific diagnoses.

EUCNEMINAE.

Eucnemis antiquatus Wickham.

Described and figured in Bull. M. C. Z., 1914, **58**, p. 437, pl. 2, fig. 9. No other specimens have been met with.

Deltometopus fossilis, sp. nov.

Plate **1**, fig. 1, 2.

Form fairly stout. Head rounded in front, surface finely, not very deeply and moderately closely punctate, bearing a scant covering of dark hairs. Antennae practically complete on one side, in life evidently reaching the prothoracic hind angles, first joint large, second short, third not in good condition but apparently rather long, fourth and following subequal, weakly serrate. Prothorax only a little broader than long, (as preserved), the sides nearly straight and, judging from the margins, about perfect, only a little sinuate in front of the base, hind angles (only one of which remains), scarcely divergent and but shortly if at all carinate, entire thoracic surface hairy like the head, minutely and sparsely punctured. Elytra not tapering until well behind the middle, striae very fine, their punctures separated in general by considerably more than their own long diameters, interspaces broad, flat, finely, sparsely punctured, each puncture bearing a hair. Length, from front of head to elytral apex, 5.90 mm.; of elytron, 3.75 mm.

Described from one specimen.

Type.— In the Museum of the University of Colorado. It was collected at Station 14, Florissant, Colo., by S. A. Rohwer.

The generic reference is made with a good deal of doubt, but the form, sculpture, and vestiture point, in general, to the Eucneminae and the antennae and size are not unlike Deltometopus.

Fornax relictus, sp. nov.

Plate 1, fig. 3.

Outline rather fusiform. Head of moderate size. Antennae not preserved except the basal portion of one which is in too poor condition to be described. Prothorax beneath with wide marginal groove, prosternum not very well shown in front, but the lobe was evidently short, sutures grooved and quite broad, probably nearly straight although one of them is thrown out of line by pressure, spine not long, pointed, its margin with a fine but distinct bead. The hind angle, shown on one side only, is well developed, not strongly divergent, front angles not completely preserved, sides, as far as shown, evidently convergent anteriorly and slightly arcuate. Punctuation of the entire underside obscure, apparently minute, with marks of a covering of fine hairs. Elytra with striato-punctate sculpture showing through. Length, from front of head to abdominal apex, exclusive of sex organ, 6.85 mm.

Described from one specimen.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo.

In form and size, this beetle is not unlike the fossil *Microrhagus vulcanicus,* described herein, but has stronger elytral sculpture. The wide marginal prothoracic grooves and the type of the prosternal sutures are much like those of the recent *Fornax hornii* of our eastern states, which is said to be the female of *F. calceatus.* In general, the form and size are also similar to that species.

MICRORHAGUS VULCANICUS, sp. nov.

Plate 1, fig. 5.

Form moderately stout. Head finely but closely and rather deeply punctured. Antennae not well preserved, about eight joints remaining which are scarcely serrate and indicate that if entire the antennal apex would pass well beyond the prothoracic hind angles. Prothorax finely, sparsely punctate and strongly hairy, apex much narrowed, sides rather pronouncedly arcuate, hind angles divergent. Scutellum injured so that the exact shape is not definable. Elytra a little arcuate at sides and conjointly rounded at apex, hairy, slightly striate near the base, the remainder of the surface finely punctulate. Length, from front of head to elytral apex, 7.40 mm.; of elytron, 4.85 mm.

Described from one specimen.

Type.— No. 2,775 M. C. Z. Florissant, Colo. (No. 13,034 S. H. Scudder Coll.).

This insect has a type of sculpture and vestiture common in the Eucneminae, and if assigned to that subfamily would go in Microrhagus by the form of the coxal plates and the apparent structure of the basal antennal joints. Compared with the recent *M. triangularis,* the present species has finer sculpture throughout and is of larger size.

MICRORHAGUS MIOCENICUS, sp. nov.

Plate 1, fig. 4.

Form fairly stout. Head quite large, strongly transverse, anterior margin arcuate, surface obscurely but closely and rather coarsely punctured on the front, less strongly on the vertex, which becomes nearly smooth posteriorly. Antennae poorly preserved, not strongly serrate, reaching to or behind the prothoracic hind angles. Prothorax about one fourth broader than long, apex narrower than the base, front angles not well marked, sides regularly and moderately arcuate, base nearly truncate, hind angles, (only one of which is preserved), acute, slightly divergent and distinctly carinate. The surface is finely, very obscurely and not closely punctate, with a thin clothing of moderately long dark hairs. Elytra broad at humeri, sinuately tapering behind them, hardly striate and with faint rows of punctures, the vestiture like that of the prothoracic disk. Underside not shown. Length, from front of head to elytral apex, 5.60 mm.; of elytron, 3.60 mm.

Described from one specimen.

Type.— In the Museum of the University of Colorado. It was collected by Mrs. W. P. Cockerell at Station 14, Florissant, Colo.

In general, this beetle is a good deal like the preceding, but is smaller and has very differently shaped elytra.

ELATERINAE.

LACON EXHUMATUS, sp. nov.

Plate **1**, fig. 6, 7.

Form stout. As the specimen shows the underside only, no details of the sculpture of the upper surface can be given. Antennae with only the middle portion well preserved, joints stout, moderately serrate. Prothorax beneath punctured on the flanks but not very closely nor strongly, prosternum somewhat smoother, lobe short, blunt, sutures curved, excavate, more deeply in front. Elytra, as shown from below, merely indicating that they were marked with rows of coarse punctures. Abdominal punctuation obscure. Length, from front of head to elytral apex, 7.75 mm.; of elytron, about 5.00 mm., the base being too obscure to locate exactly.

Described from one specimen.

Type.— No. 2,776 M. C. Z. Florissant, Colo. (No. 4,456 S. H. Scudder Coll.).

This insect has the look of Lacon and agrees in the structure of the underside of the prothorax, the short antennae and the elytral sculpture. It is smaller than the average recent *L. rectangularis*, widespread in North America, but is just the same size as some southern specimens in my collection.

CARDIOPHORUS LITHOGRAPHUS, sp. nov.

Plate **2**, fig. 1–3.

Form moderately stout. Head not well preserved, very minutely punctulate. Prothorax nearly equal in length and breadth, apex narrower than base, sides rather faintly arcuate, hind angles acute and only a little divergent. Surface polished, with sparse, fine punctuation and signs of delicate pubescence. Scutellum cordiform, impunctate. Elytra finely, regularly striate, the strial punctures deep but not coarse, rounded or very slightly oblong, ordinarily separated in each stria by about their own diameters or sometimes a little less. Interstitial spaces flat, extremely minutely punctulate and with fine pubescence. Underside almost perfectly smooth. Length, 8.25 mm.; of elytron, 5.25 mm.

Described from one specimen, with counterpart.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo. With it are associated four others in my collection; two in the collection of the U. S. National Museum; one in the Museum of the University of Colorado, found by Professor Cockerell's party at Station 14; and No. 2,777–2,784 M. C. Z. (No. 4,746, 6,007, 7,650, 8,731, 11,174, 11,782, 12,423, 14,329, S. H. Scudder Coll.).

The generic reference is based on the form of the metacoxal plates, the truncate prosternal spine, the cordiform scutellum and the cariniform mark on the underside of the prothoracic flanks. The sculpture is entirely that of Cardiophorus and the present species is not unlike the common recent North American *C. convexus* in most of its characters.

CARDIOPHORUS FLORISSANTENSIS, sp. nov.

Plate 2, fig. 4, 5.

Form stout. Head minutely, closely punctulate and pubescent. Antenna not complete, but in life evidently not quite reaching the prothoracic basal angles, the articulations too obscure to allow of comparisons of their lengths. Prothorax one fifth broader than long, narrower apically, sides regularly arcuate to near the hind angles which are acute and somewhat divergent, base sinuate each side, rather prominent at middle, surface very minutely punctulate and finely, not closely, pubescent. Scutellum cordiform. Elytra finely striate, the striae with rounded or slightly elongate punctures which are separated usually by less than their own diameters, interstitial spaces broad, flat, not visibly punctured, pubescent. Underside nearly smooth. Length, from front of head to elytral apex, 10.70 mm.; of elytron, 6.60 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado, collected by G. N. Rohwer at Station 13, Florissant, Colo.; with it are associated a specimen, with counterpart, found by S. A. Rohwer and one found by Mrs. W. P. Cockerell at the same place; five examples in the collection of the U. S. National Museum; and No. 2,771–2,774 M. C. Z. (No. 84, 2,094, 12,421, 12,425 S. H. Scudder Coll.).

Larger than *C. lithographus* (p. 501), but otherwise similar. I do not think there is any doubt of the specific distinctness of the two. The coxal plates, as shown, look quite different but I am afraid to depend entirely upon these as the edges may become broken and change the apparent form.

CARDIOPHORUS COCKERELLI, sp. nov.

Plate 2, fig. 6.

Form stout. Head minutely, obscurely punctured, antennae wanting. Prothorax nearly one and one third times as broad as long, not much narrowed anteriorly, sides strongly rounded, hind angles short but prominent, carinate, basal sinuations pronounced, surface rather densely and more strongly and coarsely punctured than the head. Scutellum apparently imperfect, pointed behind. Elytra short, broad, somewhat obtusely conjointly rounded apically, surface striate, the striae moderately deep, their punctures strong, rounded or a little elongate, close-set, separated ordinarily by less than their own diameters, interspaces broad, flat, roughened somewhat but not distinctly punctured. The entire upper surface of the prothorax and elytra shows signs of rather fine pubescence. Length, from front of head to elytral apex, 6.20 mm.; of elytron, 3.85 mm.

Described from one specimen.

Type.— No. 2,765 M. C. Z. Florissant, Colo. (No. 1,916 S. H. Scudder Coll.). With it are associated No. 2,766–2,767 M. C. Z. (No. 6,379, 10,639 S. H. Scudder Coll.); and three specimens, two with counterparts, in the Museum of the University of Colorado, all from Station 14, bearing the numbers 151, 178 and 179, 209 and 258. No. 2,768–2,770 M. C. Z. (No. 7,476, 9,160, 12,041 S. H. Scudder Coll.) probably belong here.

The underside is not shown in the type, but the specimen No. 2,767 M. C. Z. (No. 10,639 S. H. Scudder Coll.), displays it well, exhibiting moderately curved prosternal sutures, truncate spine and nearly smooth surface. This beetle is similar to the recent North American

C. cardisce, but seems to be a little more coarsely punctured on the prothorax. It is smaller than the Florissant species *C. lithographus* and *C. florissantensis*, and much less coarsely punctured than the fossil *Horistonotus coloradensis* from the same shales.

CARDIOPHORUS REQUIESCENS, sp. nov.

Plate **2**, fig. 7, 8.

Form fairly elongate. Head minutely and closely punctulate. Antennae wanting. Prothorax too badly damaged for description of the form, punctuation sparse and fine. Scutellum cordiform. Elytral striae extremely fine, the punctures shallow, somewhat elongate and, in general, separated by several times their own diameters. Underside nearly smooth, the visible punctures being sparse and small. Length, from front of head to elytral apex, 6.65 mm.; of elytron, 4.15 mm.

Described from one specimen.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo.

This seems to separate easily from the other Florissant fossil Cardiophori by the finer sculpture and especially in the distant strial punctures. The generic reference is plainly indicated by the form of the prosternal spine and of the scutellum.

CARDIOPHORUS (?) DEPRIVATUS, sp. nov.

Plate **2**, fig. 9, 10.

Form stout. Head not visibly punctured. Antennae apparently with the second joint hardly shortened, the third a trifle shorter than the fourth, the following, up to and including the tenth, subequal and only faintly serrate. Prothorax scarcely at all punctulate, about one third wider than long, sides regularly and not strongly arcuate, the angles not prominent. Scutellum a little elongate, pointed at tip but not strictly cordiform. Elytra hardly three and one third times as long as wide, rather strongly tapering, apices conjointly rounding, surface without sculpture. Underside practically smooth throughout, prosternal sutures curved, convex inwards, metacoxal plates suddenly narrowed externally. Length, from front of head to elytral apex, 5.15 mm.; of one elytron, 3.50 mm.

Described from one specimen with its counterpart.

Type.— In the Museum of the University of Colorado. It was collected at Station 13, Florissant, Colo., by Professor Cockerell's expedition of 1906. The obverse bears his number 99, the reverse, 127.

Unfortunately the prosternal spine is damaged so that its form is not shown and while the beetle is perhaps not a true Cardiophorus, because of the form of the scutellum, it seems best to place it provisionally in that genus on account of its general similarity to some of the recent species with faint sculpture.

HORISTONOTUS COLORADENSIS, sp. nov.

Plate 2, fig. 11, 12.

Form fairly stout. As the specimen shows from the underside, the sculpture of the head is not visible. Prothorax, beneath, with the flanks and prosternum distinctly but rather finely and only moderately closely punctate, the punctures ordinarily separated by their own diameters or a little less, not very regularly spaced. Metasternum a little more finely punctured. Abdomen punctured in general, like the prothorax, the proximal segments somewhat more finely and sparsely than the distal, the terminal one with the punctures crowded laterally. Scutellum not visible. Elytra displayed in reverse, the punctuation showing through. It is arranged in striae, the punctures coarse, rounded, deep, mostly separated by less than their own diameters, those near the elytral apices nearly touching. Length, 6.60 mm.; of elytron, 4.10 mm.

Described from one specimen.

Type.— In the collection of H. F. Wickham. Florissant, Colo. Possibly No. 2,763–2,764 M. C. Z. (No. 815, 6,384 S. H. Scudder Coll.) may also belong here.

In this case, the generic reference is not made with much confidence. However, the size, the truncate prosternal spine and the form of the coxal plates point to the Cardiophori. The punctuation of the underside is coarser than usual in Cardiophorus but is quite similar in disposition to that of the recent *Horistonotus simplex* from the southwestern United States.

CRYPTOHYPNUS EXTERMINATUS, sp. nov.

Plate 1, fig. 8, 9.

Form short, broad, and stout. Surface hardly visibly punctate anywhere, but this may possibly be due to the rather coarse texture of the stone in which the specimen is preserved. Head rather large. Antennae with the first joint long and thick, the second and third scarcely shorter than those succeeding, none of which are much produced at the angles so that the organ is only weakly serrate. Prothorax a little distorted, a trifle more than one third wider than long, apex feebly emarginate, front angles pointed but obtuse, width greatest in front of the middle, sides moderately strongly arcuate to a point near the acute hind angles, slightly divergent and carinate, base sinuate each side. Scutellum suborbicular. Elytra a little more than twice the length of the prothoracic median line, pointed at apex. Length, 4.55 mm.

Described from one specimen.

Type.— No. 2,762 M. C. Z. Florissant, Colo. (No. 11,280 S. H. Scudder Coll.).

The form and antennal structure are those of Cryptohypnus. In size, it approximates the recent *C. nocturnus* of Canada and our northern states, but the sculpture, if properly shown on the stone, is more like that of the much smaller *C. pectoralis.* This last species, in its varieties, has a wide distribution in North America today.

CRYPTOHYPNUS HESPERUS, sp. nov.

Plate 3, fig. 1.

Form fairly slender for this genus. Sculpture of head not definable. Antennae not well shown, but one side is well enough preserved to indicate that they reached at any rate to the hind angles of the prothorax. Prothoracic width about one fourth greater than the length, surface sculpture obscurely preserved, base not much broader than the apex, sides rather strongly rounding, hind angles short, not divergent, base deeply sinuate each side. Scutellum rounded or oblong. Elytra tapering, arcuate at sides, apices conjointly rounded, sculpture not well defined, showing only traces of faint striae. Length, from front of head to abdominal apex, 4.30 mm.; of elytron, 2.60 mm.

Described from one specimen.

Type.— No. 2,761 M. C. Z. Florissant, Colo. (No. 5,294 S. H. Scudder Coll.).

This has the size and general appearance of Cryptohypnus and, as far as shown, the sculpture seems to be like that of the recent *C. pectoralis.* In form, the present insect differs widely from the Florissant fossil *C. exterminatus.*

ANCHASTUS ERUPTUS, sp. nov.

Plate **3**, fig. 2, 3.

Form moderately stout. Sculpture of head not definable. Antennae long, that on the right side, (as preserved), showing nine joints, the terminal one of which, in life, would have reached well behind the prothoracic basal angles, so it is likely that if complete the antennae would have extended nearly to the elytral middle. The first joint is large, the second small, third much larger than the second but a little shorter than the fourth, fifth not in good condition, sixth and following longer than the fourth, serrations, in general, well pronounced. Prothorax with strongly curved prosternal sutures, lobe short, spine stout and short, punctuation of flanks and sternum minute and inconspicuous. Elytra conjointly rounded apically, sculpture not showing through. Abdominal sculpture very fine. Length, from front of head to elytral apex, 4.80 mm.; of elytron, about 3.00 mm.

Described from one specimen.

Type.— No. 2,760 M. C. Z. Florissant, Colo. (No. 11,281 S. H. Scudder Coll.).

The coxal plates do not show up well, but seem to be very narrow externally and broad internally, as in Anchastus. This genus has similar antennal and prosternal characters, also.

ANCHASTUS DILUVIALIS, sp. nov.

Plate **3**, fig. 4.

Form moderately elongate. Head not visibly punctured beneath. Antennae poorly defined. Prothorax closely, distinctly, and regularly but finely punctate on the flanks and sternum, the grooves strongly double, curved. The prothoracic outline is obscured to some extent by flattening, but as preserved the apex is very nearly as wide as the base, the sides little curved, none of the angles plainly shown. Elytra long, tapering, coarsely punctatostriate, the punctures separated by about their own diameters, interstitial areas not wide nor visibly punctured. Length, from front of head to elytral apex, 5.50 mm.; of elytron, about 3.60 mm.

Described from one specimen.

Type.— No. 2,759 M. C. Z. Florissant, Colo. (No. 11,277 S. H. Scudder Coll.).

The generic reference is not certain, being based upon the sternal grooves, the size, sculpture, and general form. This species easily separates from the preceding by being much more coarsely sculptured. Both are represented by undersides only.

MONOCREPIDIUS DUBIOSUS, sp. nov.

Plate **4**, fig. 1.

Form only moderately elongate. Head finely, sparsely, and indistinctly punctate. Prothorax about one fourth broader than long, base and apex subequal, none of the angles very prominent, side margin nearly regularly but not strongly arcuate, base broadly emarginate in front of the scutellum, sinuate each side, surface not well preserved but showing a few fine punctures. Scutellum subquadrate. Elytra nearly three times the length of the prothoracic median line, conjointly rounded at apex, surface finely and not deeply striate, the striae with small, slightly elongate punctures, separated in each row by approximately their own diameters, interstitial spaces flat and not visibly punctured. Underside finely and feebly punctulate or nearly smooth. Length. 4.50 mm.; of elytron, 2.65 mm.

Described from one specimen, with counterpart.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo.

This specimen is not especially well preserved nor does it offer any striking characters. The underside shows the prosternal sutures to be double, nearly straight, somewhat excavated anteriorly, the prosternum rather narrow, the spine acuminate at tip. The hind coxal plates are not well defined, but I think they are suddenly dilated internally. Both legs and antennae are too poor for description. No more suitable generic position can be suggested at present, though all of the species of Monocrepidius that I know are more strongly striate and somewhat differently proportioned.

ELATER ROHWERI, sp. nov.

Plate **3**, fig. 5, 6.

Form moderately elongate. Head rather short, distinctly but finely punctured, somewhat sparsely on the sides and still more finely and sparsely on the vertex, minutely hairy. Antennae quite slender, scarcely at all serrate, not reaching the tips of the prothoracic hind angles, basal joint large, second and third not well defined, the remainder subequal, all finely hairy. Prothorax strongly narrowed anteriorly, front margin arcuately emarginate, anterior angles not very prominent, sides moderately arcuate, hind angles long, sharp, a little divergent with distinct discal carina and possibly with an external marginal one as well. The base is a little emarginate in front of the scutellum. Thoracic disk with a well-impressed, smooth median line on basal one fifth, the middle area finely and sparsely, sides more strongly and closely punctate, entire surface hairy. Scutellum oblong, punctured and hairy. Elytra bluntly pointed, tapering, striae not deep, with rows of slightly elongate, rather fine punctures separated in general by about their own long diameters, interstitial spaces broad, flat, hairy, but not punctured excepting the small depressions from which the hairs arise. Legs of moderate length, finely hairy. Underside of body with most of the details not well defined, but the prothoracic side-pieces are fairly strongly though not densely nor coarsely punctured, the prosternum more finely. The spine is pointed, the lobe broken at tip but apparently not long, the sutures double, excavated, the metacoxal plates broad internally, the abdomen finely hairy, scarcely punctulate. Length, from front of head to elytral apex, 7.60 mm.; of elytron, 5.00 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado. Florissant, Colo., collected at Station 14 by Professor Cockerell and bearing his numbers 192 and 211.

The general features of this beetle point to Elater as a fairly exact reference. It is most like some of the less strongly sculptured modern North American species, such as *E. sanguinipennis* or *E. behrensi*, but is rather smaller. Compared with the fossil *E. scudderi*, the present species may easily be distinguished by the distinctly striato-punctate elytra, while *E. florissantensis,* from these shales, is larger and has a differently formed prothorax.

The specific name is given for Mr. S. A. Rohwer, a member of Professor Cockerell's expeditions and now of the U. S. National Museum staff.

ELATER FLORISSANTENSIS, sp. nov.

Plate 3, fig. 9.

Form moderately elongate. Head large, closely and rather strongly but finely punctured. Antennae poorly defined. Prothorax about one seventh broader than long, wider near the apex than at base, finely, deeply, and closely punctured, sides regularly and somewhat faintly arcuate anteriorly, nearly straight posteriorly, front angles obtuse, hind angles long, a little divergent and apparently bicarinate. Scutellum oval. Elytra rather strongly tapering, apices conjointly a little rounded, surface clothed with rather long but not close hairs of a darker color, striae fairly coarse, their punctures of moderate size, usually a little elongate and separated by less than their own long diameters, interstitial spaces flat, scarcely visibly punctulate. Length, from front of head to elytral apex, 8.25 mm.; of elytron, 5.40 mm.; of prothorax, along median line, 2.00 mm.

Described from one specimen.

Type.— No. 2,752 M. C. Z. Florissant, Colo. (No. 8,034 S. H. Scudder Coll.). With it are associated No. 2,753–2,758 M. C. Z. (No. 79 and 103, 6,869, 8,891, 9,200 and 11,732 S. H. Scudder Coll.).

The generic reference is only fairly exact. In thoracic outline the fossil more nearly resembles our recent *E. areolatus* than any other North American species known to me. The sculpture and vestiture of the elytra is something of the type seen in the living *E. cordatus* from our Pacific coast. Unfortunately the outlines of the metacoxal plates cannot be distinguished.

ELATER SCUDDERI, sp. nov.

Plate 3, fig. 7, 8.

Form rather elongate. Head quite closely and coarsely punctured. Antennae incomplete, but when entire probably not reaching the prothoracic hind angles. Prothorax very little wider than long, sides, (judging by the better preserved one), gently and regularly rounding, base and apex subequal or the latter a little narrower, front angles obtuse, not at all prominent, hind angles moderately acute, a little divergent and distinctly carinate. Thoracic punctuation rather shallow and obscure, close and only fairly fine, surface strongly hairy. Scutellum pointed at apex. Elytra moderately tapering to apex, not striate and very obscurely punctate but hairy like the thorax. Length, from front of head to elytral tip, 7.10 mm.; of elytron, 4.75 mm.

Described from one specimen.

Type.— No. 2,751 M. C. Z. Florissant, Colo. (No. 12,485 S. H. Scudder Coll.).

Looks a good deal like *E. florissantensis* but is smaller and has non-striate elytra. Probably it does not belong to Elater in the modern sense.

MEGAPENTHES PRIMAEVUS, sp. nov.

Plate 4, fig. 2.

Form rather elongate. Head finely but extremely densely and quite deeply punctured, somewhat less strongly upon the vertex than upon the front. Antennae reaching well beyond the base of the prothorax, heavier than in most of the fossil Elateridae but not very strongly serrate, only the middle joints well defined. Prothorax narrower at apex than at base, approximately equal in length and breadth, surface finely and closely punctured though not quite so strongly as the head, sides but little arcuate, front angles short, hind ones not very long, a little divergent and distinctly carinate. Scutellum oblong. Elytra conjointly rounded apically, finely striate, strial punctures rounded, mostly separated by about their own diameters or a little more, interspaces flat, wide, finely and not very closely punctate, the punctures distinctly smaller than those of the striae. Underside not shown. Length, 8.90 mm.; of elytron, 5.60 mm.; of prothorax, 2.35 mm.

Described from one specimen.

Type.— No. 2,750 M. C. Z. Florissant, Colo. (No. 10,859 S. H. Scudder Coll.). With it are associated two others, in the Museum of the University of Colorado, one with counterpart (No. 226 and 249). The only one with definite record is from Station 13B, collected by S. A. Rohwer.

As seen under magnification, the general effect is much like that of the recent *M. aterrimus* of the Pacific states. I am not sure of the antennal structure, but it looks as if the second and third joints are very short and what can dimly be seen of the hind coxal plate on one side has the appearance of being broad internally and much narrowed to the outer edge. Of course the generic reference is subject to correction in the event of more material coming to hand.

CRYPTAGRIOTES, gen. nov.

Body form almost like that of Cryptohypnus. Coxal plates nearly linear, scarcely narrowed externally, obtusely lobed over the thighs. Prosternum short with a small, subtruncate lobe, sutures nearly straight, apparently excavate anteriorly.

Type.— *C. minusculus*, sp. nov.

CRYPTAGRIOTES MINUSCULUS, sp. nov.

Plate 4, fig. 3.

Form moderately stout. Head large. Antennae not well preserved, slender, reaching beyond the prothoracic hind angles. Prothorax probably somewhat distorted, but, as preserved, wider in front of the middle where the width is a little greater than the length. Sides very gently arcuate, angles not well shown. Prosternal sutures nearly straight, lobe rather short, entire under surface of the prothorax finely punctulate and pubescent. Elytra two and one fourth times the prothoracic length, conjointly rounded apically, the sides somewhat arcuate, sculpture not showing through. Abdomen very finely punctulate and pubescent. Length, from front of head to elytral apex, 4.00 mm.; of elytron, about 2.30 mm.

Described from one specimen.

Type.— No. 2,749 M. C. Z. Florissant, Colo. (No. 8,653 S. H. Scudder Coll.).

Judging from the form of the coxal plates, this little beetle should go into the Corymbitini, possibly near Agriotes, but it does not agree with any genus known to me.

AGRIOTES NEARCTICUS, sp. nov.

Plate 4, fig. 6.

Form elongate. Head minutely but very closely and distinctly punctured. Antennae poorly preserved, but what remains of one of them indicates that they were short and slender, scarcely serrate. Prothorax broken along the side margins, obscuring the shape, punctuation almost exactly like that of the head, the punctures finely mamillate, nearly touching, even on the middle of the disk. Elytra relatively rather elongate as compared with their width, striae apparently very shallow but their rows of punctures are fairly deep and strong, each puncture somewhat elongate, those in each series separated by a little more or less than their own long diameters. Interstitial spaces scarcely perceptibly punctulate, but with marks of a fine, moderately short pubescence. Length, from front of head to elytral apex, 8.00 mm.; of elytron, 5.50 mm.

Described from one specimen.

Type.— No. 2,748 M. C. Z. Florissant, Colo. (No. 6,653 S. H. Scudder Coll.).

While resembling the Florissant fossils, *Limonius florissantensis* and *L. praecursor*, this insect is more elongate and more delicately punctured than the former and differs from the second in the closer punctuation of the head and prothorax as well as the almost complete lack of it in the elytral interspaces. The coxal plates are not very clearly shown, but I think they are correctly exhibited in the drawing. The front seems to be higher than the labrum, as indicated by the distinct line of demarcation in the fossil, and the slender antennae are like those of Agriotes.

AGRIOTES COMMINUTUS, sp. nov.

Plate 4, fig. 4, 5.

Form rather elongate. Head coarsely, closely but not very deeply punctured. Eyes and antennae not defined. Prothorax with the margins badly broken, so that the exact shape is not discernible, but it was evidently only a little wider than long, with a large discal dark spot, similar to that of the recent North American *A. fucosus*, surface sculpture obscure, the prosternal sutures, which show through, nearly straight and apparently excavate anteriorly. Elytra not less than two and one half times the prothoracic length, apices broken, surface finely striate, the striae with distinctly elongate, well-impressed punctures which are separated in each row by approximately their own long diameters, interstitial spaces flat, broad, apparently punctate. Abdominal dorsal sculpture, on the portion exposed by the spreading of the elytra, obscure. Length, from front of head to abdominal apex, 6.70 mm.; of portion of elytron as preserved, 3.60 mm.

Described from one specimen.

Type.— No. 2,747 M. C. Z. Florissant, Colo. (No. 11,800 S. H. Scudder Coll.).

Since the general preservation of this beetle is poor, I should not have ventured to describe it, had not the coxal plate been well shown on one side. Taken into account with the form of the prosternal sutures, the sculpture and the coloration, this seems to indicate a probable affinity with Agriotes.

LIMONIUS ABORIGINALIS, sp. nov.

Plate **5**, fig. 1–4.

Form stout for the genus. Head practically smooth. Antennae just about reaching the hind prothoracic angles, moderately serrate, second and third joints subequal, their united length about the same as that of the fourth which, however, is broader and begins the serration. Eyes normal. Prothorax about one fourth broader than long, not visibly sculptured above, apex scarcely emarginate, narrower than the base, sides arcuately broadening to about the middle thence slightly sinuately narrowing posteriorly, hind angles well defined, acute but not divergent. Scutellum oblong oval. Elytra with sides less parallel than in most modern species of Limonius, apices conjointly rounded, surface rather finely but quite distinctly and regularly striate, strial punctures becoming less distinct posteriorly. rounded or slightly oblong, separated by about their own diameters, Interstitial areas with signs of fine pubescence. Underside almost smooth, only a few small, scattering punctures being visible. Legs not displayed. Length, from front of head to elytral apex, 6.65 mm.

Described from one specimen, with counterpart.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo. With it are associated No. 2,737–2,738 M. C. Z., (No. 7,971 and 10,952 S. H. Scudder Coll.). Most likely No. 2,739–2,746 M. C. Z. (No. 2,870, 8,345, 8,549, 8,753, 12,766, 8,226, 8,842 and 11,788 S. H. Scudder Coll.), belong to the same species. There are also three additional specimens in my collection.

While shorter and broader than most recent species of Limonius, the essential characters, as shown by the coxal plates (which are narrow and but little dilated internally, only moderately prominent over the insertion of the thighs), the prosternal sutures, (double, little curved), the short prosternal lobe and the blunt scutellum correspond very well with this genus. The basal antennal structure is similar to what we see in the recent *L. crotchii* of the western United States, but the general aspect is more that of *L. nitidulus* from the same district.

LIMONIUS FLORISSANTENSIS, sp. nov.

Plate **5**, fig. 5–7.

Form moderately elongate. Head rather finely and extremely closely and deeply but regularly punctured. Antennae about reaching the prothoracic base, faintly serrate. Prothorax approximately one seventh broader than long, apex and base subequal, surface quite evenly punctate, about as coarsely as the head but more sparsely, apex nearly truncate, front angles obtuse, sides regularly arcuate to about the middle, which is the broadest part, thence narrowing to near the base, hind angles acute, carinate, but hardly divergent. Scutellum oblong oval. Elytra about two and two thirds times the length of the prothoracic median line, finely, sharply striate, strial punctures fine, somewhat elongate, separated by approximately their own long diameters, interstitial spaces flat, broad, confusedly and sparsely punctate, the punctures of varying sizes, the largest distinctly smaller than those of the striae. Underside punctured throughout, rather coarsely and closely on the prosternum and flanks, more finely on the meso- and metasternal sclerites, the abdomen finely punctate except on the last segment and along the sides, where the sculpture is coarser. Length, 8.40 mm.; of elytron, 5.50 mm.

Described from two specimens, one with counterpart.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo. With it are associated another specimen, with counterpart, in my own collection; two from Station 14 in the Museum of the University of Colorado; No. 6,572 of the Princeton collection; and No. 2,734 M. C. Z. (No. 11,664 S. H. Scudder Coll.). It is possible that No. 2,735, 2,736 M. C. Z. (No. 8,340, 10,492 S. H. Scudder Coll.), represent the same species.

Characters pointing to Limonius are seen in the coxal plates, hind tarsi, prosternal sutures, and antennae. The short prosternal lobe is more like Nothodes. Compared with *L. aboriginalis*, the present species is much more roughly sculptured.

LIMONIUS PRAECURSOR, sp. nov.

Plate 5, fig. 8, 9.

Form elongate, slender. Head finely but very regularly and distinctly punctured, the punctures separated by their own diameters or less. Antennae short, showing only a few of the joints well enough for description, but these are about one half longer than wide and weakly serrate. Prothorax punctured similarly to the head but a little more finely, the sides not in very good condition but evidently subparallel, length and width subequal. Scutellum obscure. Elytra about two and two fifths times the prothoracic length, subparallel, finely but very distinctly striate, the striae with decidedly elongate punctures which are separated in each row by their own diameters, a little more or less, interstitial spaces broad and flat, very minutely punctulate. Underside of prothorax finely but clearly punctured, rather closely on the flanks, less so on the prosternum, sutures double, a little curved in front, nearly straight behind, broader anteriorly, lobe moderate. Length, from front of head to elytral apex, 8.50 mm.; of elytron, 5.75 mm.

Described from one specimen, with counterpart.

Type.— No. 2,730 and 2,731 M. C. Z. Florissant, Colo. (No. 9,417 and 10,558 S. H. Scudder Coll.). With it is doubtfully associated another specimen, also with counterpart, No. 2,732 and 2,733 M. C. Z. (No. 12,049 and 12,762 S. H. Scudder Coll.).

In general form and sculpture, this approaches closely to *L. florissantensis*. However, the present insect has relatively shorter elytra, with markedly finer and sparser cephalic and prothoracic punctuation.

LIMONIUS SHOSHONIS, sp. nov.

Plate 5, fig. 10.

Form fairly elongate. Head finely and rather vaguely punctate. Antennae lacking. Prothorax almost exactly equal in length and breadth, surface finely, not deeply, but fairly closely punctate, apex not much narrower than the base, sides feebly arcuate, front angles nearly rectangular, hind angles carinate, sharp, only a little divergent. Scutellum nearly triangular. Elytra moderately tapering, finely striate, strial punctures a little elongate, quite fine, not very deep and separated from each other in the same row by approximately their own diameters, interstitial spaces flat, wide, scarcely visibly punctulate, finely hairy. Length, from front of head to elytral apex, 7.25 mm.; of elytron, 4.35 mm.

Described from one specimen.

Type.— In the Museum of the University of Colorado. It was collected by Professor Cockerell at Station 14, Florissant, Colo., in 1906 and bears his number 58.

The beetle is provisionally placed in Limonius chiefly on account of its form and sculpture. It is smoother than the other Florissant species referred to this genus.

LIMONIUS VOLANS, sp. nov.

Plate 5, fig. 11.

Form rather elongate. Head deeply punctured, closely and relatively coarsely on the front, more finely and sparsely on the vertex. Antennae wanting. Prothorax a trifle broader than long, more finely and much more sparsely punctured than the head except near the side margins where the sculpture is much coarser and closer than on the disk. Base somewhat broader than the apex, sides very little arcuate, front angles short, hind ones of moderate length and but slightly divergent. Elytra two and three fourths times the prothoracic length, conjointly rounded at apex, finely striate, the strial punctures not very close nor well defined, interstitial spaces flat, with strong, fairly sparse punctures, more pronounced, though probably not larger, than those of the striae. Length, from front of head to elytral apex, 9.00 mm.; of elytron, 5.60 mm.

Described from one specimen.

Type.— In the Museum of the University of Colorado. It was collected at Station 14, Florissant, Colo., by G. N. Rohwer, while a member of one of Professor Cockerell's parties.

Separates from *L. florissantensis,* with which it agrees in the relatively coarse interstitial punctuation, by having a much finer and sparser sculpture of the head and particularly of the thorax. The generic reference is provisional, being based mostly on facies.

ATHOUS LETHALIS, sp. nov.

Plate **6**, fig. 1, 2.

Form elongate, parallel. Head finely and extremely densely punctured and with a short pubescence. Antennae long, slender, faintly serrate, apparently not entire but reaching far beyond the prothoracic hind angles, basal joints too poor to allow of their definition. Prothorax punctured similarly to the head but a trifle more coarsely and less deeply, length and breadth equal, front angles slightly prominent, sides nearly straight to the hind angles which are acute and a little divergent, base sinuate each side. Scutellum oblong oval. Elytra a little over three times the length of the prothoracic median line, apices conjointly rounded, finely striate and pubescent, the striae with small, deep, nearly circular or slightly elongate punctures which are separated in the series by their own diameters or something more. Underside of prosternum closely and finely punctured, the prothoracic flanks less strongly, sculpture of the remainder of the thoracic sclerites and abdomen very obscure. Length, from front margin of prothorax to elytral tip, 8.40 mm.; of elytron, 5.50 mm.

Described from one specimen, with counterpart.

Type.— No. 2,728 and 2,729 M. C. Z. Florissant, Colo. (No. 8,464 and 8,713 S. H. Scudder Coll.).

The prothorax is ornamented with a broad brown stripe, about one third of the discal width, occupying the median area from base to apex, similar to that seen in the recent *A. excavatus,* from California. The latter insect, however, is much more coarsely sculptured. The coxal plates are not well displayed in the fossil, but the prosternal lobe and sutures, as well as the general form, correspond well with the genus in which I have placed it.

ATHOUS CONTUSUS, sp. nov.

Plate **6**, fig. 3, 4.

Form very elongate, subparallel. Head moderately coarsely and fairly closely punctured. Antennae slender, and, when complete, probably reaching or passing the prothoracic hind angles. Only a few of the joints are well defined and these are scarcely serrate. Prothorax long, narrow, the sides not in good condition, apparently wider at base than at apex, hind angles only moderately pronounced, flanks rather closely but not coarsely punctured, prosternum more strongly. Elytra long, conjointly rounded at apex, strongly sculptured, the punctures of the striae rounded, separated longitudinally by their own diameters or a little more. Abdominal punctuation fine, moderately close. Length, from front of head to elytral apex, 11.15 mm.; of elytron, 7.65 mm.

Described from one specimen.

Type.— No. 2,727 M. C. Z. Florissant, Colo. (No. 8,346 S. H. Scudder Coll.).

The specimen is preserved in such a way as to show the upper side of the head and elytra and the details of the underside of the prothorax, due to the manner of splitting the stone. It retains a portion of the raised frontal margin and the aspect is quite that of Athous.

ATHOUS FRACTUS, sp. nov.

Plate **6**, fig. 5.

Form elongate. Head with a rather well-pronounced frontal margin, surface finely punctate and pubescent. Antennae weakly serrate, slender, the basal and apical joints poorly defined, but in life the antennal tip evidently attained or passed the prothoracic hind angles. Prothorax very little broader than long, surface finely, not closely punctate and pubescent. Sides very little arcuate, angles small, the hind ones not in good preservation but evidently carinate and at least moderately prominent. The notch in front of the angle, as shown on the figure, is perhaps adventitious. Scutellum oblong. Elytra broken at tip but apparently, if complete, not much, if any, less than three times as long as the prothorax, finely striate, the striae with irregularly spaced, round, or often elongate or elliptical, punctures separated by more or less than their own long diameters. Interstitial spaces flat, broad, pubescent but scarcely visibly punctulate. Only one leg shows, which is of moderate size. Length of fragment, 13.40 mm.; of prothorax, along median line, 3.50 mm.

Described from one specimen.

Type.— In the Museum of the University of Colorado. It was collected at Station 14, Florissant, Colo., by S. A. Rohwer.

Placed in Athous because of the form, the coxal plates (only indistinctly seen), the frontal margin and the very long prosternal lobe which shows through as indicated, Plate **6**, fig. 5. In this figure, the dotted lines will show the courses of the elytral striae, but the punctures are actually somewhat smaller and more numerous than the dots which might be taken to represent them. It seems smoother than the recent North American species known to me.

PARANOMUS EXANIMATUS, sp. nov.

Plate **6**, fig. 6, 7.

Form only moderately elongate. Head practically smooth. Antennae not well enough preserved to show the relative sizes of most of the joints, but they are quite weakly or scarcely serrate, reaching, in life, beyond the prothoracic hind angles. Prothorax in poor condition and probably somewhat distorted, but as shown it is a little more than one fifth broader than long, wider in front of the middle, front angles a little acute, sides moderately arcuate in anterior three fourths, thence sinuate, in reverse curve, to the hind angles which are sharp and slightly divergent, base broadly emarginate in front of the scutellum, sinuate each side, surface minutely, sparsely punctured. Scutellum suborbicular. Elytra three times the length of the prothoracic median line, conjointly rounded apically, not striate nor visibly punctured but finely pubescent. Underside nearly smooth. Length, 7.00 mm.; of elytron, 4.30 mm.

Described from one specimen, with counterpart.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo. With it is associated, somewhat doubtfully, another from the same source.

Most probably a Paranomus, but more finely sculptured than *P. costalis* or *P. estriatus,* the only recent species know to me. The prosternal sutures are moderately curved, the hind coxal plates but slightly dilated externally and without a distinct tooth over the thighs. The beetle differs from *P. laevissimus* in the proportions of the elytra and prothorax, as well as in some minor details which may be gathered from the descriptions.

PARANOMUS LAEVISSIMUS, sp. nov.

Plate 6, fig. 10.

Form fairly stout. Head very finely punctulate, a little more coarsely anteriorly. Antennae poorly preserved, slender, scarcely at all serrate. Prothorax almost absolutely smooth, neither side completely preserved but from a combination of the two it is evident that the base and apex were subequal, the width about one third greater than the length, sides arcuate, sinuate in front of the hind angles which are somewhat divergent, acute and carinate, basal margin strongly sinuate each side. Scutellum obscure, apparently oblong. Elytra two and three fifths times the length of the prothoracic median line, without sculpture except two lines of faint elongate punctures near the outer edges and some still weaker ones on the disk, no visible hair marks. Underside almost perfectly smooth. Length, from front of head to elytral apex, 8.10 mm.; of elytron, 4.75 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado, collected at Station 14, Florissant, Colo., by Mrs. W. P. Cockerell.

Perhaps the most striking characteristic of this beetle is the almost total lack of sculpture. The form is like that of Cardiophorus and the curved prosternal sutures are similar to those found in that genus, but the spine is not truncate nor is the scutellum cordiform. The nature of the prosternal sutures forbids reference to Cryptohypnus, and while the coxal plates are not distinctly shown I think they are gradually smaller externally as in the Corymbitini. The practical lack of elytral striation leads me to refer the insect to Paranomus.

PARANOMUS HEERI, sp. nov.

Plate 6, fig. 8, 9.

Form only fairly elongate. Head minutely, sparsely punctulate on the vertex, more closely at front and sides. Antennae bent under the body, lying along the breast near the prosternal sutures, not well enough defined for description. Prothorax punctulate, finely and sparsely, the outline incomplete on one side but evidently the width is about one half greater than the median length, base and apex subequal, front angles obtuse, sides regularly rounding to the hind angles which are obscure and probably short. Scutellum oval. Elytra a little over three times the prothoracic length, apices conjointly rounding, surface distinctly and rather deeply but finely and sparsely punctured without any definite strial arrangement. Underside obscurely, finely punctate. Length, from front of head to elytral apex, 4.65 mm.; of elytron, 3.25 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado. It was collected at Station 14, Florissant, Colo., by Dr. W. M. Wheeler, while a member of one of Professor Cockerell's expeditions.

Probably not a true Paranomus, but I can find no better place for it and the assemblage of visible characters points in that direction. The metacoxal plates are not suddenly dilated, the prosternal lobe is moderate, the sutures nearly straight, apparently slightly excavate anteriorly, the elytra not striate. The size is somewhat less than that of the recent *P. estriatus*, from Mt. Washington.

LUDIOPHANES, gen. nov.

Form of Ludius. Elytra confusedly punctate, not striate. Coxal plates gradually narrowed externally and not toothed over the insertion of the thighs. Scutellum ogival.

Type.— *L. haydeni*, sp. nov.

LUDIOPHANES HAYDENI, sp. nov.

Plate 4, fig. 7–9.

Form moderately elongate, tapering a little to both ends. Head short, closely, deeply, and coarsely punctured, except on the extreme frontal region where the sculpture is more shallow. Antennae very slightly longer than the prothoracic median line but not reaching the tips of the hind angles, eleven jointed, feebly serrate, first joint large, second shorter than the third, third and fourth subequal in length, eleventh much longer than the tenth. Eyes not strongly convex. Prothorax a little broader than long, slightly narrower at apex than at base, front angles acute, sides gently and almost regularly arcuate, faintly sinuate in front of the hind angles which are acute and feebly divergent. The thoracic apex seems hardly emarginate, the base is notched in front of the scutellum and sinuate each side. Punctuation of pronotum close, deep, and rather coarse over the entire surface, the punctures everywhere separated by much less than their own diameters and but slightly less crowded along the median line than at sides, each with a central mark which looks as if it may have been the point of insertion of a hair or scale. Scutellum oval, much longer than wide, coarsely punctured. Elytra moderately tapering, not pointed at apices, confusedly but in general evenly punctured except that the punctures become somewhat more sparse posteriorly where they are separated by spaces about equal to or a little more than their own diameters. Each puncture carried a moderately long, curved dark hair, giving a somewhat shaggy appearance to the surface. Underside of body well preserved, showing the following features: — prothoracic flanks finely and densely punctured, prosternum, including the spine, more coarsely and deeply; lobe strong, rounded; sutures double, nearly straight, excavate anteriorly; meso- and metasternal areas similarly but in general less closely punctate, coxal plates narrow, little dilated externally, with a rounded lobe over the insertion of the thighs; abdominal punctuation rather fine but deep, closer externally but everywhere well separated. Legs not well displayed. Length, from front of head to tip of abdomen, excluding sex organ, 14.25 mm.; of prothorax, along median line, 3.35 mm.; of elytron, 9.00 mm.; of antenna, 3.65 mm.; width of prothorax, 3.75 mm.

Described from one specimen, with counterpart.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo.

This is probably the finest and best preserved specimen I have seen among the Elateridae of the Florissant shales. The aspect is much like that of a Ludius or of a Megapenthes, like the recent western North American *M. aterrimus,* but the form of the coxal plates indicates a position with the Corymbitini. The punctuation does not agree with that of any species of the group known to me and serves at once to differentiate it from all the Florissant fossil Elateridae of similar size. The antenna and sex organ are omitted (Plate **4**, fig. 7) but the former is shown (Plate **4**, fig. 8).

CORYMBITES PRIMITIVUS Wickham.

Described in American journal of science, 1908, ser. 4, **26**, p. 77, fig. 2. It is a large species, about 22 mm. in length, and seems not to have been particularly rare. The type is in the Peabody Museum of Yale University and was found at Station 14, Florissant, Colo., by G. N. Rohwer. None are in the collections of the Museum of Comparative Zoölogy, but I have a good example, with counterpart, and the prothorax of another from the Wilson Ranch.

CORYMBITES GRANULICOLLIS Wickham.

This was described in the same article as the preceding. It is still larger, 24 mm. long, and is the most striking of all the Florissant Elateridae as far as size is concerned. The type is with the Peabody Museum, at Yale University. I have a very good specimen obtained at Florissant from a local collector who claimed to have found it in the railroad cut that runs through the Corixa bed. I doubt the accuracy of his statement. The original locality was Station 14, which has yielded many beautiful insects of various families.

CORYMBITES SUBMERSUS, sp. nov.

Plate **7**, fig. 1–3.

Form fairly elongate. Head moderately coarsely punctured on the front, vertex becoming only faintly sculptured. Antennae broken, but enough remains to show that the second joint is shorter than the third and, judging from the portions preserved, the organ, when complete, reached slightly beyond the points of the prothoracic hind angles. The antennal serrations are faint. Mandibles a little prominent. Prothorax short, narrow anteriorly, broadest across the base, the sides arcuate near the front angles, which are obtuse, but becoming nearly straight to the hind angles which are long, sharp, divergent, and carinate. The sculpture of the pronotum consists of an extremely fine punctuation, with rather sparse pubescence. There is a fine lateral marginal bead the full length of each side. Scutellum oblong. Elytra striate, the striae with fine, deep, rounded or somewhat elongate punctures separated in the series by something more or less than their own diameters. Underside showing that the prosternum is strongly, closely and rather coarsely punctured around the anterior portion of the lobe, nearly smooth at middle, side pieces vaguely punctate, abdomen thinly pubescent, the punctuation fine, shallow and sparse. Legs poorly preserved, of moderate size. Length, from front of head to abdominal apex, 13.50 mm.; of elytron, 9.45 mm.; of prothorax, along median line, 2.45 mm.; width of prothorax across base, just in front of hind angles, 3.35 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado. It was collected by G. N. Rohwer, at Station 14, Florissant, Colo.

Easily distinguished from the other Florissant fossil Corymbites by the short prothorax and widely divergent hind angles which give the appearance of the recent *C. appressus* from the northern United States and Canada. That species, however, has the prosternum and elytra differently sculptured. The prosternal, coxal, and antennal characters of the fossil all agree well with the genus in which it is placed.

CORYMBITES RESTRUCTUS, sp. nov.

Plate 7, fig. 4.

Form fairly elongate, tapering to the ends as in the recent *C. hieroglyphicus*. Since the specimen is exposed in ventral view, no description of the upper surface can be given. Head poorly preserved, antennae not shown. Prothorax rather closely and fairly coarsely punctured beneath, more deeply and strongly on the prosternum, spine margined at sides, lobe much rounded, hind angles long and acute, slightly diverging. Metasternal and abdominal punctuation much shallower and more vague than that of the prothorax. Hind leg moderately long, the first tarsal joint not much lengthened, the fourth and fifth obscured. Elytra pointed at apex, sides rather strongly rounding. Length, from front of head to abdominal apex, but without extruded sex organ, 16.30 mm.

Described from one specimen.

Type.— In the Museum of the University of Colorado. It was collected by Mrs. W. P. Cockerell at Station 14, Florissant, Colo.

Undoubtedly a Corymbites and easily distinguished from *C. primitivus* or *C. granulicollis* by its smaller size and more fusiform outline.

CORYMBITES PROPHETICUS, sp. nov.

Plate **7**, fig. 5.

Form stout. Head in very poor preservation, finely, regularly, and closely punctate. Antennae wanting. Prothorax at sides punctured almost exactly like the head, a little more finely and sparsely on the disk, about one fourth broader than long, sides nearly regularly arcuate, somewhat more suddenly in front, anterior angles slightly acute, hind ones quite strongly so, feebly divergent and carinate. Scutellum oblong. Elytra quite strongly arcuate at sides, apices conjointly rounded, finely striate, striae with distinct but not coarse punctures which are circular or slightly elongate and separated in each series by their own diameters or less. Interspaces broad, flattened or nearly so, finely punctulate and distinctly pubescent. Legs wanting. Length, from front of head to elytral tip, 10.90 mm.; of elytron, 6.55 mm.; of prothorax along median line, 3.00 mm.

Described from one specimen.

Type.— No. 2,724 M. C. Z. Florissant, Colo. (No. 13,657 S. H. Scudder Coll.). With it is associated, somewhat doubtfully, No. 2,275 M. C. Z. (No. 11,282 S. H. Scudder Coll.). Two poor specimens from Station 13 and 13B are in the Museum of the University of Colorado.

This is quite surely a Corymbites and is of the same general form as the recent *C. aereipennis*, common in the northern and mountain regions of this continent. The sculpture seems not to have been very different. The size and outline will distinguish it from all the other fossil Florissant species.

OXYGONUS PRIMUS, sp. nov.

Plate **7**, fig. 6.

Form fairly stout. Head not well preserved, showing no sculpture. Antennae moderately long but the individual joints are not definable. Prothorax stout, suborbicular, the sides strongly rounded, apex and base subequal, prosternal grooves double, somewhat curved, lobe long, front edge quite arcuate and strongly advanced, sculpture fine or nearly wanting. Elytron about four times as long as wide, moderately pointed apically, punctatostriate, the punctures rounded or somewhat elongate and separated in each row by more than their own diameters. Abdomen and legs wanting. Length, from front of head to elytral apex, 6.00 mm.; of elytron, 3.85 mm.

Described from one specimen.

Type.— No. 2,726 M. C. Z. Florissant, Colo. (No. 6,381 S. H. Scudder Coll.).

A small species, about the size of the recent Californian *O. ater*. The form of the prothorax will separate it at once from all the other fossil Florissant Elateridae.

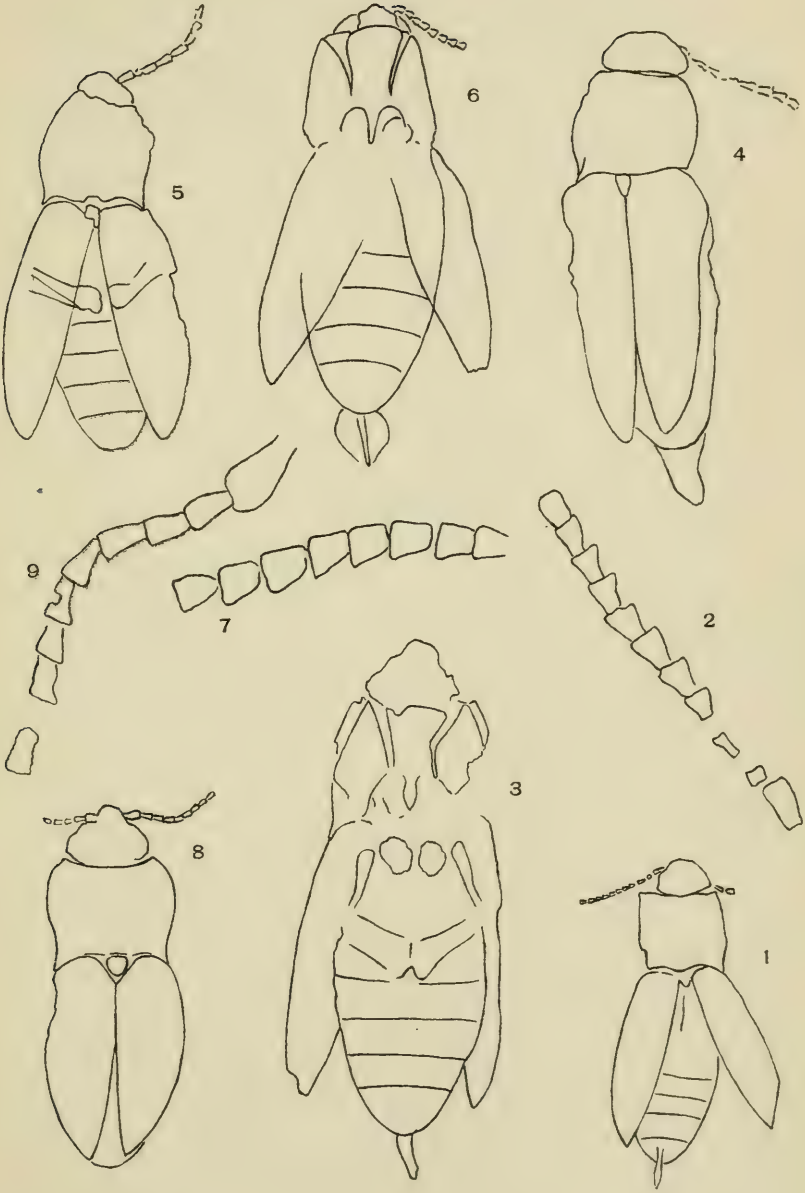
MELANACTES COCKERELLI Wickham.

Originally described in the American journal of science, 1908, ser. 4, **26**, p. 77, fig. 3. The type is in the Peabody Museum of Yale University and was collected at Station 14, Florissant, Colo. No other specimens have come to light. It is a large insect, 23.50 mm. in length and similar in general appearance to the Florissant fossil *Corymbites granulicollis.*

PLATE 1.

PLATE 1.

Fig. 1. Deltometopus fossilis.
2. Deltometopus fossilis, antenna.
3. Fornax relictus.
4. Microrhagus miocenicus.
5. Microrhagus vulcanicus.
6. Lacon exhumatus.
7. Lacon exhumatus, antenna.
8. Cryptohypnus exterminatus.
9. Cryptohypnus exterminatus, antenna.

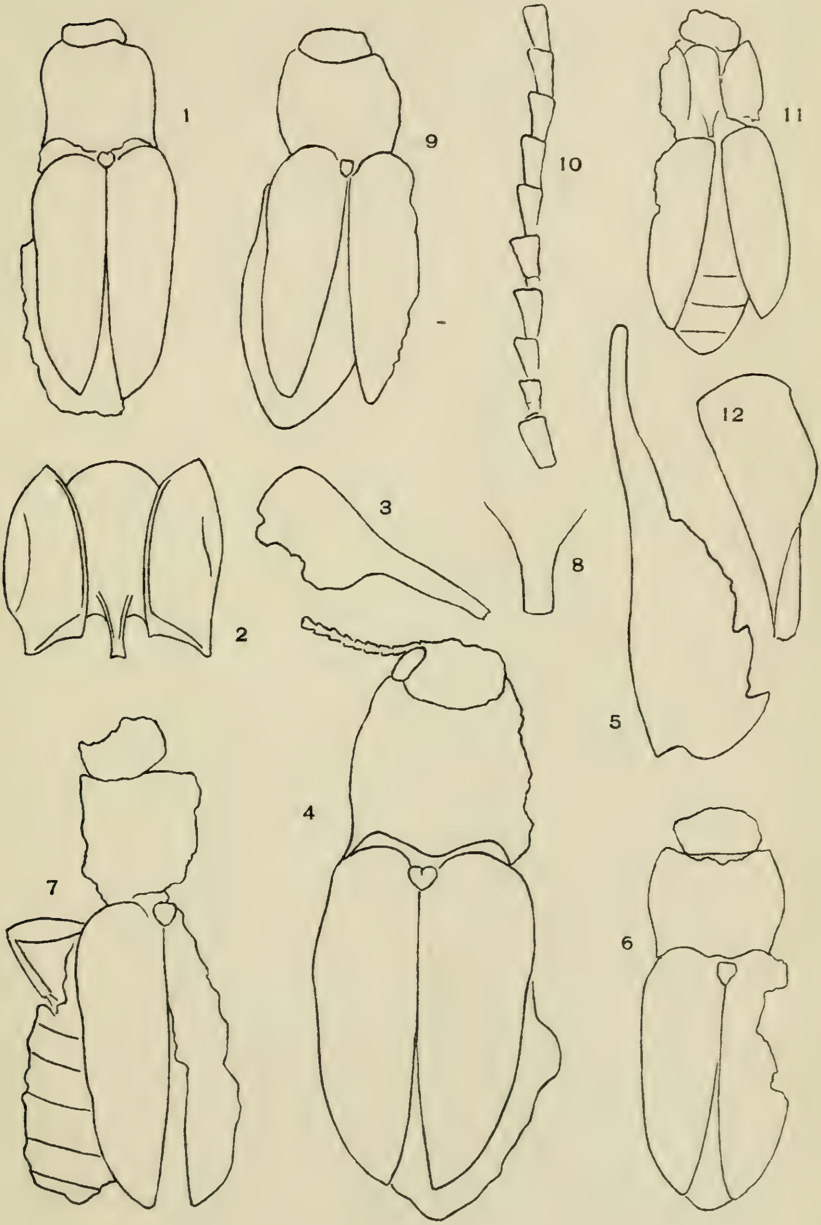


HELIOTYPE CO., BOSTON.

PLATE 2.

PLATE 2.

Fig. 1. Cardiophorus lithographus.
2. Cardiophorus lithographus, underside of prothorax.
3. Cardiophorus lithographus, hind coxal plate.
4. Cardiophorus florissantensis.
5. Cardiophorus florissantensis, hind coxal plate.
6. Cardiophorus cockerelli.
7. Cardiophorus requiescens.
8. Cardiophorus requiescens, prosternal spine.
9. Cardiophorus (?) deprivatus.
10. Cardiophorus (?) deprivatus, antenna.
11. Horistonotus coloradensis.
12. Horistonotus coloradensis, hind coxal plate.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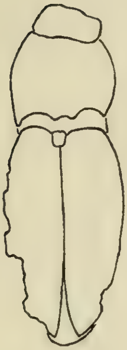
HELIOTYPE CO., BOSTON.

PLATE 3.

PLATE 3.

Fig. 1. Cryptohypnus hesperus.
2. Anchastus eruptus.
3. Anchastus eruptus, antenna.
4. Anchastus diluvialis.
5. Elater rohweri.
6. Elater rohweri, underside of prothorax.
7. Elater scudderi.
8. Elater scudderi, antenna.
9. Elater florissantensis.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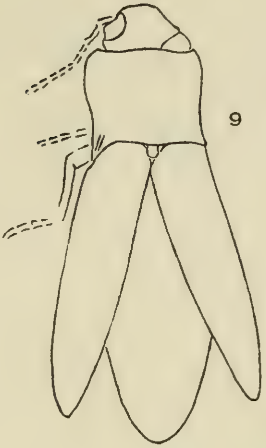
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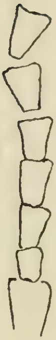
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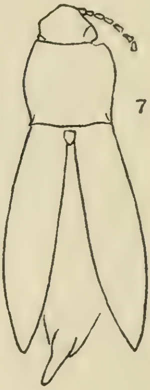
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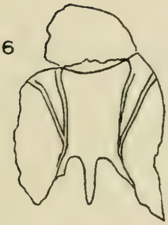
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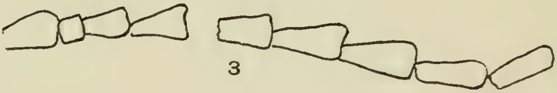
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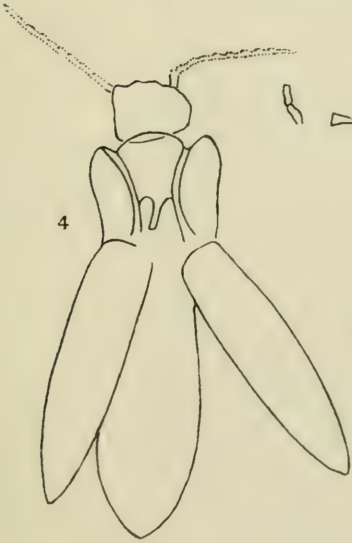
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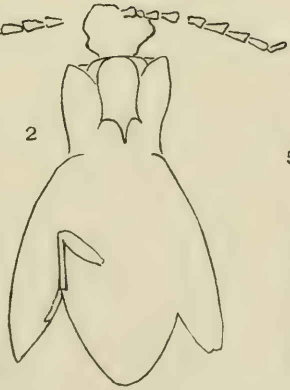
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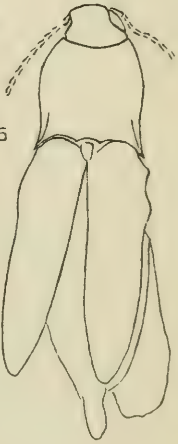
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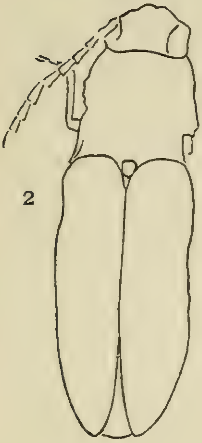
HELIOTYPE CO., BOSTON.

PLATE 4.

PLATE 4.

Fig. 1. Monocrepidius dubiosus.
2. Megapenthes primaevus.
3. Cryptagriotes minusculus.
4. Agriotes comminutus.
5. Agriotes comminutus, hind coxal plate.
6. Agriotes nearcticus.
7. Ludiophanes haydeni.
8. Ludiophanes haydeni, antenna.
9. Ludiophanes haydeni, hind coxal plate.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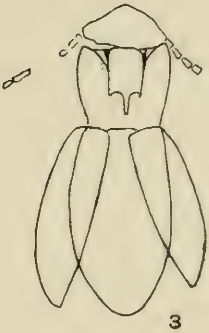
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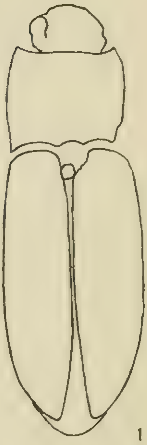
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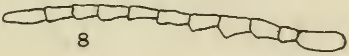
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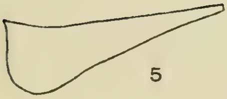
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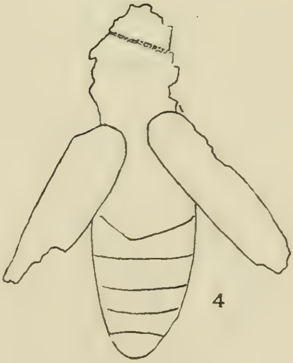
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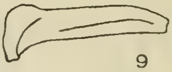
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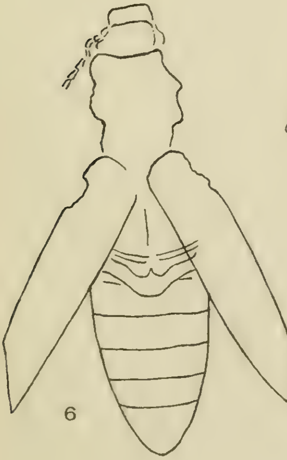
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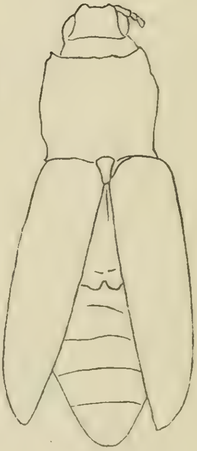
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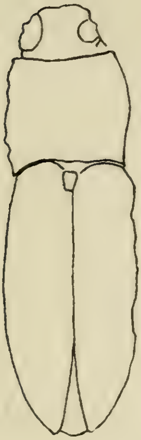
HELIOTYPE CO., BOSTON.

PLATE 5.

PLATE 5.

Fig. 1. Limonius aboriginalis.
2. Limonius aboriginalis, underside of prothorax.
3. Limonius aboriginalis, hind coxal plate.
4. Limonius aboriginalis, antenna.
5. Limonius florissantensis.
6. Limonius florissantensis, hind coxal plate.
7. Limonius florissantensis, hind tarsus.
8. Limonius praecursor.
9. Limonius praecursor, antenna.
10. Limonius shoshonis.
11. Limonius volans.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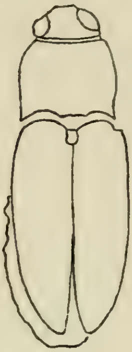
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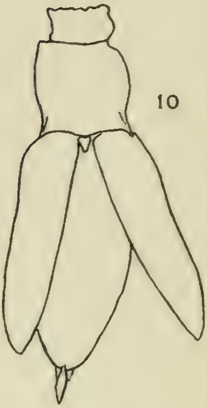
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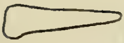
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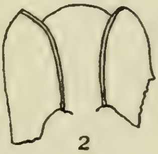
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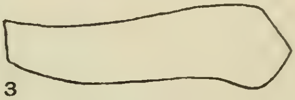
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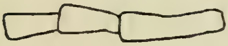
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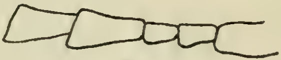
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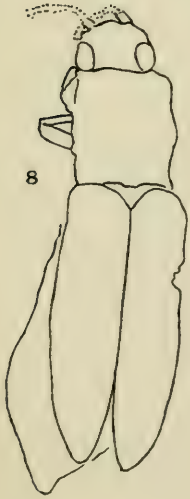
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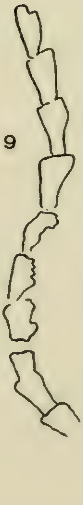
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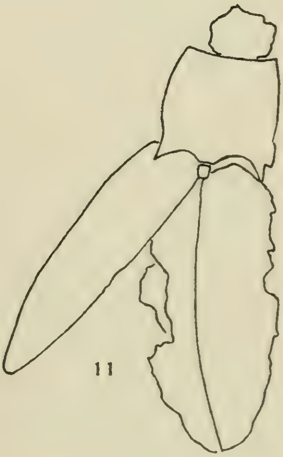
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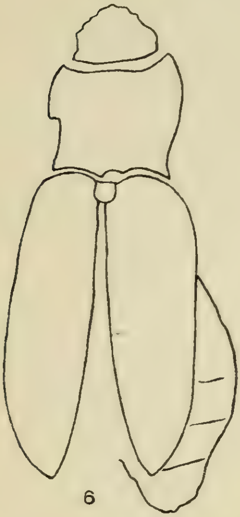
HELIOTYPE CO., BOSTON.

PLATE 6.

PLATE 6.

Fig. 1. Athous lethalis.
2. Athous lethalis, underside of prothorax.
3. Athous contusus.
4. Athous contusus, antenna.
5. Athous fractus.
6. Paranomus exanimatus.
7. Paranomus exanimatus, hind coxal plate.
8. Paranomus heeri.
9. Paranomus heeri, hind coxal plate.
10. Paranomus laevissimus.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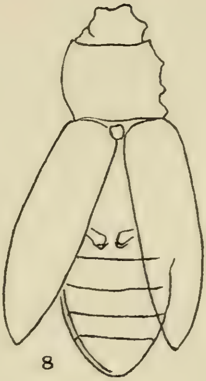
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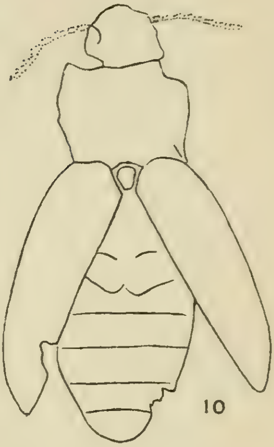
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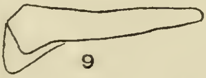
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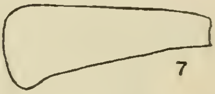
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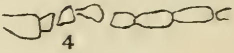
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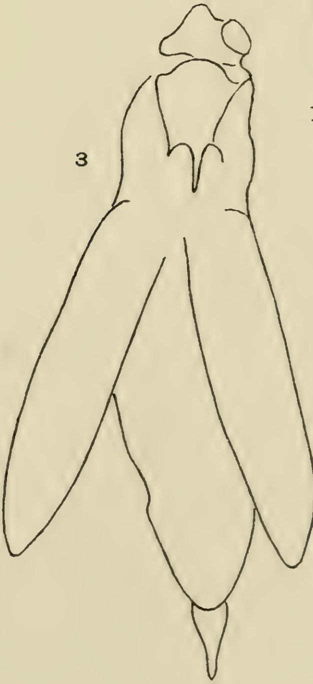
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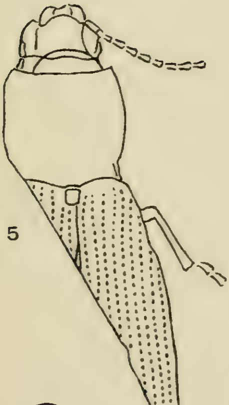
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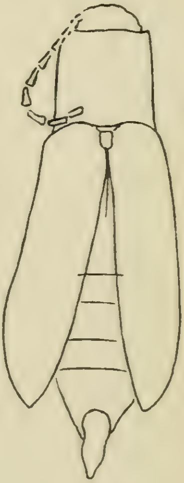
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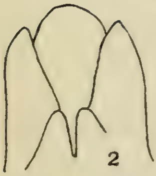
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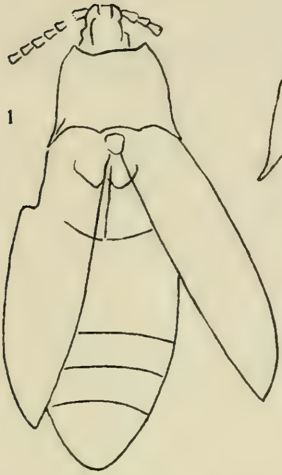
PLATE 7.

PLATE 7.

Fig. 1. Corymbites submersus.
2. Corymbites submersus, underside of prothorax.
3. Corymbites submersus, hind coxal plate.
4. Corymbites restructus.
5. Corymbites propheticus.
6. Oxygonus primus.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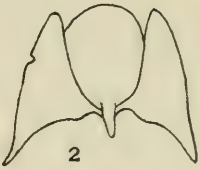
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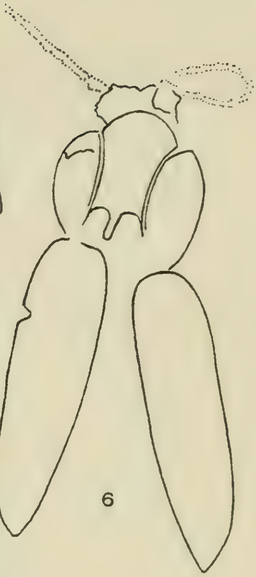
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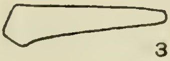
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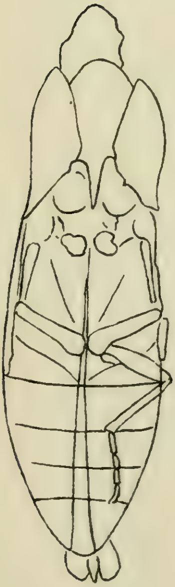
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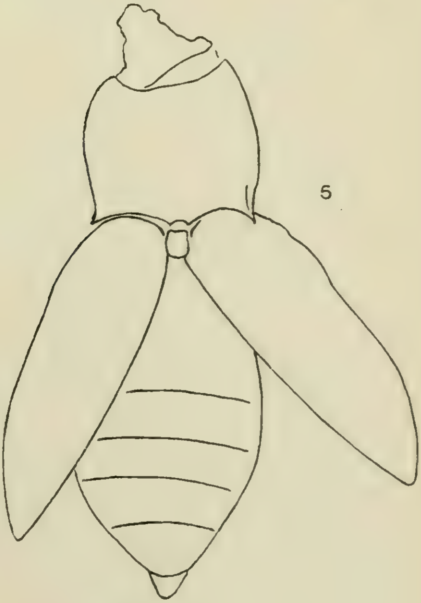
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